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OSCAR, II.

THE

VOYAGE OF THE VEGA

ROUND

ASIA AND EUROPE

WITH A HISTORICAL REVIEW
OF PREVIOUS JOURNEYS ALONG THE NORTH COAST OF THE
OLD WORLD

BY

A. E. NORDENSKIOLD

TRANSLATED BY ALEXANDER LESLIE

WITH FIVE STEEL PORTRAITS, NUMEROUS MAPS, AND ILLUSTRATIONS

IN TWO VOLUMES—VOL. I

London
MACMILLAN AND CO.
1881

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TO HIS MAJESTY

KING OSCAR II.

THE HIGH PROTECTOR OF THE VEGA EXPEDITION

THIS SKETCH OF THE VOYAGE

HE SO MAGNANIMOUSLY AND GENEROUSLY PROMOTED

IS WITH THE DEEPEST GRATITUDE

MOST HUMBLY

Dedicated

BY

A. E NORDENSKIÖLD.

AUTHOR'S PREFACE.

In the work now published I have, along with the sketch of the voyage of the *Vega* round Asia and Europe, of the natural conditions of the north coast of Siberia, of the animal and vegetable life prevailing there, and of the peoples with whom we came in contact in the course of our journey, endeavoured to give a review, as complete as space permitted, of previous exploratory voyages to the Asiatic Polar Sea. It would have been very ungrateful on my part if I had not referred at some length to our predecessors, who with indescribable struggles and difficulties—and generally with the sacrifice of health and life—paved the way along which we advanced, made possible the victory we achieved. In this way besides the work itself has gained a much-needed variety, for nearly all the narratives of the older North-East voyages contain in abundance what a sketch of our adventures has not to offer; for many readers perhaps expect to find in a book such as this accounts of dangers and misfortunes of a thousand sorts by land and sea. May the contrast which thus becomes apparent between the difficulties our predecessors had to contend with and those which the *Vega* met with during her voyage incite to new exploratory expeditions to the sea, which now, for the first time, has been ploughed by the keel

of a sea-going vessel, and conduce to dissipate a prejudice which for centuries has kept the most extensive cultivable territory on the globe shut out from the great Oceans of the World.

The work is furnished with numerous maps and illustrations, and is provided with accurate references to sources of geographical information. For this I am indebted both to the liberal conception which my publisher, Herr FRANS BEIJER, formed of the way in which the work should be executed, and the assistance I have received while it was passing through the press from Herr E. W. Dahlgren, amanuensis at the Royal Library, for which it is a pleasant duty publicly to offer them my hearty thanks.

A. E. NORDENSKIÖLD.

STOCKHOLM, *8th October*, 1881.

TRANSLATOR'S PREFACE.

HAVING been honoured by a request from Baron Nordenskiöld that I would undertake the translation of the work in which he gives an account of the voyage by which the North-East Passage was at last achieved, and Asia and Europe circumnavigated for the first time, I have done my best to reproduce in English the sense of the Swedish original as faithfully as possible, and at the same time to preserve the style of the author as far as the varying idioms of the two languages permit.

I have to thank two ladies for the help they kindly gave me in reading proofs, and my friend Herr GUSTAF LINDSTRÖM, for valuable assistance rendered in various ways.

Where not otherwise indicated, temperature is stated in degrees of the Centrigrade or Celsius thermometer. Longitude is invariably reckoned from the meridian of Greenwich.

Where distance is stated in miles without qualification, the miles are Swedish (one of which is equal to 6·64 English miles), except at page 372, Vol. I., where the geographical square miles are German, each equal to sixteen English geographical square miles.

ALEX. LESLIE.

CHERRYVALE, ABERDEEN,
24th November, 1881.

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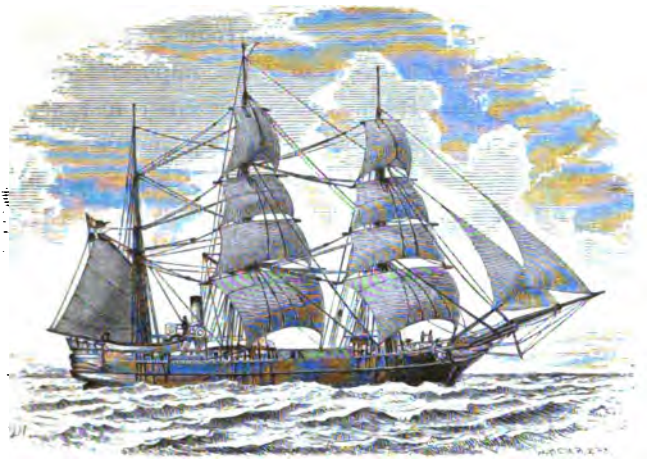
ERRATA.

Page 44, under Wood-cut *for* "chammmorus" *read* "chamæmorus."
Page 88, lines 21, 24, and 28. *for* "pearls" *read* "beads."
Page 140, line 15 from top, *for* "swallow" *read* "roll away."
Page 184, last line, *for* "one-third" *read* "one-and-a-half times."
Page 377, note, *for* "It is the general rule" *read* "For the northern hemisphere it is a general rule"
Page 476, line 12 from top, *for* "leggins" *read* "leggings."
Page 481, under wood-cut, *for* "half the natural size" *read* "one-third of the natural size."
Page 494, under wood-cut, *for* "half the natural size" *read* "one-third of the natural size."



INTRODUCTION.

THE voyage, which it is my purpose to sketch in this book, owed its origin to two preceding expeditions from Sweden to the western part of the Siberian Polar Sea, in the course of which I reached the mouth of the Yenisej, the first time in 1875 in a walrus-hunting sloop, the *Proeven*, and the second time in 1876 in a steamer, the *Ymer*.

After my return from the latter voyage, I came to the conclusion, that, on the ground of the experience thereby gained, and of the knowledge which, under the light of that experience, it was possible to obtain from old, especially from Russian, explorations of the north coast of Asia, I was warranted in asserting that the open navigable water, which two years in succession had carried me across the Kara Sea, formerly of so bad repute, to the mouth of the Yenisej, extended in all probability as far as Behring's Straits, and that a circumnavigation of the old world was thus within the bounds of possibility.

It was natural that I should endeavour to take advantage of the opportunity for making new and important discoveries which thus presented itself. An opportunity had arisen for solving a geographical problem—the forcing a north-east passage to China and Japan—which for more than three hundred years had been a subject of competition between the world's foremost commercial states and most daring navigators, and which, if we view it in the light of a circumnavigation of the old world, had, for thousands of years back, been an object of desire for geographers. I determined, therefore, at first to make use, for this purpose, of the funds which Mr. A. SIBIRIAKOFF, after my return from the expedition of 1876, placed at my disposal for the continuation of researches in the Siberian Polar Sea. For a voyage of the extent now contemplated, this sum, however, was quite insufficient On this account I turned to His Majesty the King of Sweden and Norway, with the inquiry whether any assistance in making preparations for the projected expedition might be reckoned upon from the public funds. King OSCAR, who, already as Crown Prince, had given a large contribution to the Torell expedition of 1861, immediately received my proposal with special warmth, and promised within a short time to invite the Swedish members of the Yenisej expeditions and others interested in our voyages of exploration in the north, to meet him for the purpose of consultation, asking me at the same time to be prepared against the meeting with a complete exposition of the reasons on which I grounded my views—differing so widely from the ideas commonly entertained—of the state of the ice in the sea off the north coast of Siberia.

This assembly took place at the palace in Stockholm, on the 26th January, 1877, which may be considered the birthday of the *Vega* Expedition, and was ushered in by a dinner, to which a large number of persons were invited, among whom were the members of the Swedish royal house that happened to be then in Stockholm; Prince JOHN OF GLÜCKSBURG; Dr. OSCAR

Oscar Dickson

DICKSON, the Gothenburg merchant; Baron F. W. VON OTTER, Councillor of State and Minister of Marine, well known for his voyages in the Arctic waters in 1868 and 1871; Docent F. R. KJELLMAN, Dr. A. STUXBERG, the former a member of the expedition which wintered at Mussel Bay in 1872-73, and of that which reached the Yenisej in 1875, the latter, of the Yenisej Expeditions of 1875 and 1876; and Docents HJALMAR THEEL and A. N. LUNDSTRÖM, both members of the Yenisej Expedition of 1875.

After dinner the programme of the contemplated voyage was laid before the meeting, almost in the form in which it afterwards appeared in print in several languages. There then arose a lively discussion, in the course of which reasons were advanced for, and against the practicability of the plan. In particular the question concerning the state of the ice and the marine currents at Cape Chelyuskin gave occasion to an exhaustive discussion. It ended by His Majesty first of all declaring himself convinced of the practicability of the plan of the voyage, and prepared not only as king, but also as a private individual, to give substantial support to the enterprise. Dr. Oscar Dickson shared His Majesty's views, and promised to contribute to the not inconsiderable expenditure, which the new voyage of exploration would render necessary. This is the sixth expedition to the high north, the expenses of which have been defrayed to a greater or less extent by Dr. O. Dickson.[1] He became the banker of the *Vega* Expedition, inasmuch as to a considerable extent he advanced the necessary funds, but after our return the expenses were equally divided between His Majesty the King of Sweden and Norway, Dr. Dickson, and Mr. Sibiriakoff.

I very soon had the satisfaction of appointing, as superintendents of the botanical and zoological work of the expedition in this new Polar voyage, my old and tried friends from previous

[1] The expeditions to Spitzbergen in 1868, to Greenland in 1870, to Spitzbergen in 1872-73, and to the Yenisej in 1875 and 1876.

expeditions, Docents Dr. Kjellman and Dr. Stuxberg, observers so well known in Arctic literature. At a later period, another member of the expedition that wintered on Spitzbergen in 1872-73, Lieutenant (now Captain in the Swedish Navy) L. PALANDER, offered to accompany the new expedition as commander of the vessel—an offer which I gladly accepted, well knowing, as I did from previous voyages, Captain Palander's distinguished ability both as a seaman and an Arctic explorer. Further there joined the expedition Lieutenant GIACOMO BOVE, of the Italian Navy; Lieutenant A. HOVGAARD, of the Danish Navy; Medical candidate E. ALMQUIST, as medical officer; Lieutenant O. NORDQUIST, of the Russian Guards; Lieutenant E. BRUSEWITZ, of the Swedish Navy; together with twenty-one men—petty officers and crew, according to a list which will be found further on.

An expedition of such extent as that now projected, intended possibly to last two years, with a vessel of its own, a numerous well-paid *personnel*, and a considerable scientific staff, must of course be very costly. In order somewhat to diminish the expenses, I gave in, on the 25th August, 1877, a memorial to the Swedish Government with the prayer that the steamer *Vega*, which in the meantime had been purchased for the expedition, should be thoroughly overhauled and made completely seaworthy at the naval dockyard at Karlskrona; and that, as had been done in the case of the Arctic Expeditions of 1868 and 1872-73, certain grants of public money should be given to the officers and men of the Royal Swedish Navy, who might take part as volunteers in the projected expedition. With reference to this petition the Swedish Government was pleased, in terms of a letter of the Minister of Marine, dated the 31st December, 1877, both to grant sea-pay, &c., to the officer and eighteen men of the Royal Navy, who might take part in the expedition in question, and at the same time to resolve on making a proposal to the Diet in which additional grants were to be asked for it.

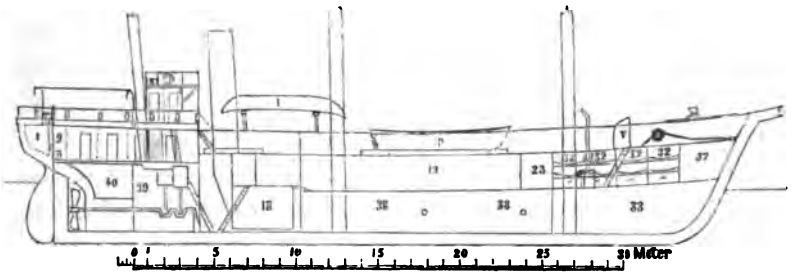
The proposal to the Diet of 1878 was agreed to with that liberality which has always distinguished the representatives of the Swedish people when grants for scientific purposes have been asked for; which was also the case with a private motion made in the same Diet by the President, C. F. WÆRN, member of the Academy of Sciences, whereby it was proposed to confer some further privileges on the undertaking.

It is impossible here to give at length the decision of the Diet, and the correspondence which was exchanged with the authorities with reference to it. But I am under an obligation of gratitude to refer to the exceedingly pleasant reception I met with everywhere, in the course of these negotiations, from officials of all ranks, and to give a brief account of the privileges which the expedition finally came to enjoy, mainly owing to the letter of the Government to the Marine Department, dated the 14th June, 1878.

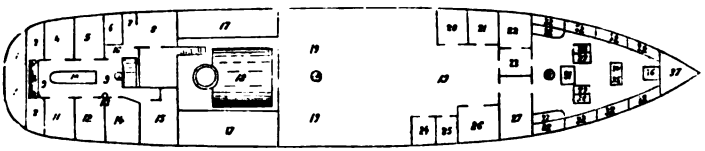
Two officers and seventeen men of the Royal Swedish Navy having obtained permission to take part in the expedition as volunteers, I was authorised to receive on account of the expedition from the treasury of the Navy, at Karlskrona—with the obligation of returning that portion of the funds which might not be required, and on giving approved security—full sea pay for two years for the officers, petty officers, and men taking part in the expedition; pay for the medical officer, at the rate of 3,500 Swedish crowns a year, for the same time; and subsistence money for the men belonging to the Navy, at the rate of one and a half Swedish crowns per man per day. The sum, by which the cost of provisions exceeded the amount calculated at this rate, was defrayed by the expedition, which likewise gave a considerable addition to the pay of the sailors belonging to the Navy. I further obtained permission to receive, on account of the expedition, from the Navy stores at Karlskrona, provisions, medicines, coal, oil, and other necessary equipment, under obligation to

THE VEGA.

Longitudinal section.

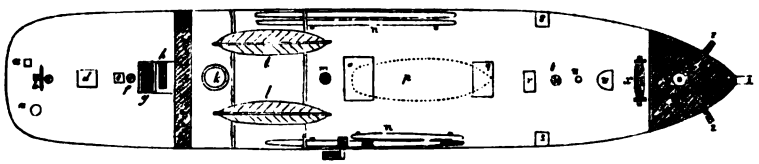


Plan of arrangement under deck.



1. Powder magazine.
2. Instrument room.
3. Sofa in gunroom.
4. Cabin for Lieut. Brusewitz.
5. Cabin for Lieuts. Bove and Hovgaard.
6. Pantry during winter.
7. Corridor.
8. Cabin for Dr. Stuxberg and Lieut. Nordquist.
9. Gunroom.
10. Table in gunroom.
11. Cabin for Dr. Almquist.
12. Cabin for Dr. Kjellman.
13. Stove.
14. Cabin for Capt. Palander.
15. Cabin for Prof. Nordenskiöld.
16. Corridor (descent to gunroom).
17. Coal bunkers.
18. Boiler.
19. Storeroom 'tween decks.
20. Pilot's cabin. } built in
21. Cabin for Lieut. Bove } Japan.
22. Cabin for two petty officers.
23. Petty officers' mess.
24. Cabin for carpenter's effects. } built in Japan
25. Cabin for collections. }
26. Cabin for library.
27. Gunroom pantry.
28. Hatch to provision room.
29. Hatch to the cable-tier.
30. Hatch to room set apart for scientific purposes.
31. Galley.
32. Bunks for the crew — double rows.
33. Cable-tier and provision store.
34. Hatch to store-room.
35. Hatch to room for daily giving out of provisions.
36. Hatch to rope-room.
37. Sail-room.
38. Storeroom for water and coal.
39. Engine-room.
40. Cellar.

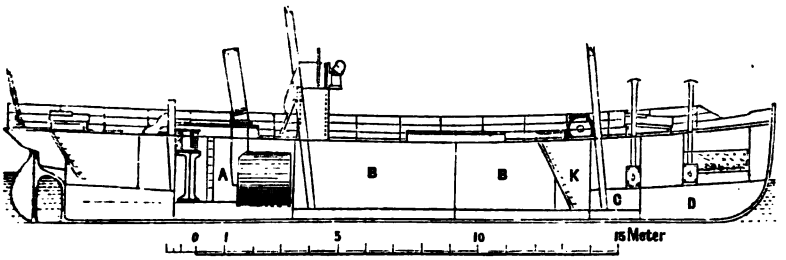
Plan of upper deck



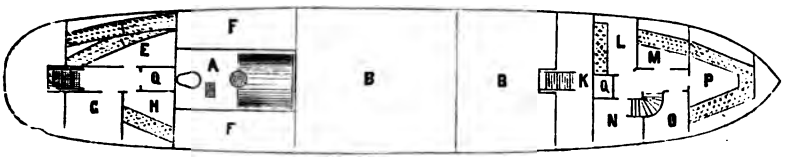
a. Thermometer case.
b. The rudder.
c. Binnacle with compass.
d., *e.* } Skylights to the gunroom.
f. Mizenmast.
g. Descent to the gunroom } companion common
h. Descent to the engine } to both.
i. Bridge.
k. Funnel.
l. Boats lying on gallows.
m. Mainmast.
n. Booms (for reserve masts, yards, &c.).
o. Main hatch.
p. Steam launch.
q. Fore hatch.
r. Hencoops.
s. Water closet.
t. Foremast.
u. Smoke-cowl.
v. Descent to lower deck (companion).
w. Windlass.
y. Capstan on the forecastle.
z. Catheads.

THE LENA.

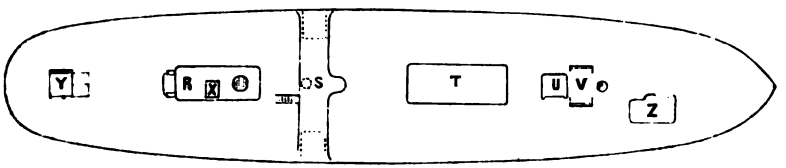
Longitudinal section.



Plan of arrangement under deck.



Plan of upper deck.



A. Engine-room.
B. B. Hold.
C. Cable.
D. Water ballast tank.
E. Forecastle.
F. F. Coal bunkers.
G. Fireman's cabin.
H. Engineer's cabin.
K. Provision-room.
L. Captain's cabin.
M. Mate's cabin.
N. Kitchen.
O. Pantry.
P. Saloon.
Q. Q. Presses.
R. Engine-room companion.
S. Bridge.
T. Hatch to hold.
U. Descent to provision-room.
V. Winch.
X. Descent to engine-room.
Y. Descent to forecastle and engineer's cabin.
Z. Descent to captain's cabin, saloon, &c.

pay for any excess of value over 10,000 Swedish crowns (about 550*l.*); and finally the vessel of the expedition was permitted to be equipped and made completely seaworthy at the naval dockyard at Karlskrona, on condition, however, that the excess of expenditure on repairs over 25,000 crowns (about 1,375*l.*) should be defrayed by the expedition.

On the other hand my request that the *Vega*, the steamer purchased for the voyage, might be permitted to carry the man-of-war flag, was refused by the Minister of Marine in a letter of the 2nd February 1878. The *Vega* was therefore inscribed in the following month of March in the Swedish Yacht Club. It was thus under its flag, *the Swedish man-of-war flag with a crowned O in the middle*, that the first circumnavigation of Asia and Europe was carried into effect.

The *Vega*, as will be seen from the description quoted farther on, is a pretty large vessel, which during the first part of the voyage was to be heavily laden with provisions and coal. It would therefore be a work of some difficulty to get it afloat, if, in sailing forward along the coast in new, unsurveyed waters, it should run upon a bank of clay or sand. I therefore gladly availed myself of Mr. Sibiriakoff's offer to provide for the greater safety of the expedition, by placing at my disposal funds for building another steamer of a smaller size, the *Lena*, which should have the river Lena as its main destination, but, during the first part of the expedition, should act as tender to the *Vega*, being sent before to examine the state of the ice and the navigable waters, when such service might be useful. I had the *Lena* built at Motala, of Swedish Bessemer steel, mainly after a drawing of Engineer R. Runeberg of Finland. The steamer answered the purpose for which it was intended particularly well.

An unexpected opportunity of providing the steamers with coal during the course of the voyage besides arose by my receiving a commission, while preparations were making for

A. SIBIRIAKOFF.

the expedition of the *Vega*, to fit out, also on Mr. Sibiriakoff's account, two other vessels, the steamer *Fraser*, and the sailing vessel *Express*, in order to bring to Europe from the mouth of the Yenisej a cargo of grain, and to carry thither a quantity of European goods. This was so much the more advantageous, as, according to the plan of the expedition, the *Vega* and the *Lena* were first to separate from the *Fraser* and the *Express* at the mouth of the Yenisej. The first-named vessels had thus an opportunity of taking on board at that place as much coal as there was room for.

I intend further on to give an account of the voyages of the other three vessels, each of which deserves a place in the history of navigation. To avoid details I shall only mention here that, at the beginning of the voyage which is to be described here, the following four vessels were at my disposal:—

1. The *Vega*, commanded by Lieutenant L. Palander, of the Swedish Navy; circumnavigated Asia and Europe.

2. The *Lena*, commanded by the walrus-hunting captain, Christian Johannesen; the first vessel that reached the river Lena from the Atlantic.

3. The *Fraser*, commanded by the merchant captain, Emil Nilsson.

4. The *Express*, commanded by the merchant captain, Gundersen; the first which brought cargoes of grain from the Yenisej to Europe.[1]

When the *Vega* was bought for the expedition it was described by the sellers as follows:—

"The steamer *Vega* was built at Bremerhaven in 1872-73, of the best oak, for the share-company 'Ishafvet,' and under special inspection. It has twelve years' first class $^{8}/_{3}$ I.I. Veritas,

[1] The first cargo of goods from Europe to the Yenisej was taken thither by me in the *Ymer* in 1876. The first vessel that sailed from the Yenisej to the Atlantic was a sloop, *The Dawn*, built at Yeniseisk, commanded by the Russian merchant captain, Schwanenberg, in 1877.

measures 357 register tons gross, or 299 net. It was built and used for whale-fishing in the North Polar Sea, and strengthened in every way necessary and commonly used for that purpose. Besides the usual timbering of oak, the vessel has an ice-skin of greenheart, wherever the ice may be expected to come at the vessel. The ice-skin extends from the neighbourhood of the under chain bolts to within from 1·2 to 1·5 metres of the keel. The dimensions are :—

Length of keel	... ...	37·6 metres.
Do. over deck	... ...	43·4 ,,
Beam extreme	... ...	8·4 ,,
Depth of hold	... ...	4·6 ,,

"The engine, of sixty horse-power, is on Wolff's plan, with excellent surface condensers. It requires about ten cubic feet of coal per hour. The vessel is fully rigged as a barque, and has pitch pine masts, iron wire rigging, and patent reefing topsails. It sails and manœuvres uncommonly well, and under sail alone attains a speed of nine to ten knots. During the trial trip the steamer made seven and a half knots, but six to seven knots per hour may be considered the speed under steam. Further, there are on the vessel a powerful steam-winch, a reserve rudder, and a reserve propeller. The vessel is besides provided in the whole of the under hold with iron tanks, so built that they lie close to the vessel's bottom and sides, the tanks thus being capable of offering a powerful resistance in case of ice pressure. They are also serviceable for holding provisions, water, and coal."[1]

We had no reason to take exception to this description,[2]

[1] In order to obtain sufficient room for coal and provisions most of these tanks were taken out at Karlskrona.

[2] The consumption of coal, however, was reckoned by Captain Palander at twelve cubic feet or 0·3 cubic metre an hour, with a speed of seven knots.

but, in any case, it was necessary for an Arctic campaign, such as that now in question, to make a further inspection of the vessel, to assure ourselves that all its parts were in complete order, to make the alterations in rig, &c., which the altered requirements would render necessary, and finally to arrange the vessel, so that it might house a scientific staff, which, together with the officers, numbered nine persons. This work was done at the Karlskrona naval dockyard, under the direction of Captain Palander. At the same time attention was given to the scientific equipment, principally in Stockholm, where a large number of instruments for physical, astronomical, and geological researches was obtained from the Royal Academy of Sciences.

The dietary during the expedition was fixed upon, partly on the ground of our experience from the wintering of 1872-73, partly under the guidance of a special opinion given with reference to the subject by the distinguished physician who took part in that expedition, Dr. A. Envall. Preserved provisions,[1] butter, flour, &c., were purchased, part at Karlskrona, part in Stockholm and Copenhagen; a portion of pemmican was prepared in Stockholm by Z. Wikström; another portion was purchased in England; fresh ripe potatoes[2] were procured from the Mediterranean, a large quantity of cranberry juice from Finland; preserved cloudberries and clothes of reindeer skins, &c., from Norway, through our agent Ebeltoft, and so on —in a word, nothing was neglected to make the vessel as well equipped as possible for the attainment of the great object in view.

[1] The preserved provisions were purchased part from Z. Wikström of Stockholm, part from J. D. Beauvois of Copenhagen.

[2] The potatoes were to be delivered at Gothenburg on the 1st July. In order to keep, they had to be newly taken up and yet *ripe*. They were therefore procured from the south through Mr. Carl W. Boman of Stockholm. Of these, certainly one of the best of all anti-scorbutics, we had still some remaining on our arrival at Japan.

What this was may be seen from the following

PLAN OF THE EXPEDITION,

PRESENTED TO HIS MAJESTY THE KING OF SWEDEN AND NORWAY, *July* 1877.

THE exploring expeditions, which, during the recent decades, have gone out from Sweden towards the north, have long ago acquired a truly national importance, through the lively interest that has been taken in them everywhere, beyond, as well as within, the fatherland; through the considerable sums of money that have been spent on them by the State, and above all by private persons; through the practical school they have formed for more than thirty Swedish naturalists; through the important scientific and geographical results they have yielded; and through the material for scientific research, which by them has been collected for the Swedish Riks-Museum, and which has made it, in respect of Arctic natural objects, the richest in the world. To this there come to be added discoveries and investigations which already are, or promise in the future to become, of practical importance; for example, the meteorological and hydrographical work of the expeditions; their comprehensive inquiries regarding the Seal and Whale Fisheries in the Polar Seas; the pointing out of the previously unsuspected richness in fish, of the coasts of Spitzbergen; the discoveries, on Bear Island and Spitzbergen, of considerable strata of coal and phosphatic minerals which are likely to be of great economic importance to neighbouring countries; and, above all, the success of the two last expeditions in reaching the mouths of the large Siberian rivers, navigable to the confines of China—the Obi and Yenisej—whereby a problem in navigation, many centuries old, has at last been solved.

But the very results that have been obtained incite to a continuation, especially as the two last expeditions have opened a new field of inquiry, exceedingly promising in a scientific, and I venture also to say in a practical, point of view, namely, the part of the Polar Sea lying east of the mouth of the Yenisej. Still, even in our days, in the era of steam and the telegraph, there meets us here a territory to be explored, which is new to science, and hitherto untouched. Indeed, the whole of the immense expanse of ocean which stretches over 90 degrees of longitude

from the mouth of the Yenisej past Cape Chelyuskin—the Promontorium Tabin of the old geographers—has, if we except voyages in large or small boats along the coast, never yet been ploughed by the keel of any vessel, and never seen the funnel of a steamer.

It was this state of things which led me to attempt to procure funds for an expedition, equipped as completely as possible, both in a scientific and a nautical respect, with a view to investigate the geography, hydrography, and natural history of the North Polar Sea beyond the mouth of the Yenisej, if possible as far as Behring's Straits. It may be affirmed without any danger of exaggeration, that since Cook's famous voyages in the Pacific Ocean, no more promising field of research has lain before any exploring expedition, if only the state of the ice permit a suitable steamer to force a passage in that sea. In order to form a judgment on this point, it may perhaps be necessary to cast a brief glance backwards over the attempts which have been made to penetrate in the direction which the projected expedition is intended to take.

The Swedish port from which the expedition is to start will probably be Gothenburg. The time of departure is fixed for the beginning of July, 1878. The course will be shaped at first along the west coast of Norway, past North Cape and the entrance to the White Sea, to Matotschkin Sound in Novaya Zemlya.

The opening of a communication by sea between the rest of Europe and these regions, by Sir Hugh Willoughby and Richard Chancelor in 1553, was the fruit of the first exploring expedition sent out from England by sea. Their voyage also forms the first attempt to discover a north-east passage to China. The object aimed at was not indeed accomplished; but on the other hand, there was opened by the voyage in question the sea communication between England and the White Sea; the voyage thus forming a turning-point not only in the navigation of England and Russia, but also in the commerce of the world. It also demanded its sacrifice, Sir Hugh Willoughby himself, with all the men in the vessels under his command, having perished while wintering on the Kola peninsula. In our days thousands of vessels sail safely along this route.

With the knowledge we now possess of the state of the ice in the Murman Sea—so the sea between Kola and Novaya Zemlya is called on the old maps—it is possible to sail during the latter part of summer from the White Sea to Matotschkin

without needing to fear the least hindrance from ice. For several decades back, however, in consequence of want of knowledge of the proper season and the proper course, the case has been quite different—as is sufficiently evident from the account of the difficulties and dangers which the renowned Russian navigator, Count Lütke, met with during his repeated voyages four summers in succession (1821-1824) along the west coast of Novaya Zemlya. A skilful walrus-hunter can now, with a common walrus-hunting vessel, in a single summer, sail further in this sea than formerly could an expedition, fitted out with all the resources of a naval yard, in four times as long time.

There are four ways of passing from the Murman Sea to the Kara Sea, viz :—

a. Yugor Sound—the Fretum Nassovicum of the old Dutchmen—between Vaygats Island and the mainland.

b. The Kara Port, between Vaygats Island and Novaya Zemlya.

c. Matotschkin Sound, which between 73° and 74° N. Lat. divides Novaya Zemlya into two parts, and, finally,

d. The course north of the double island. The course past the northernmost point of Novaya Zemlya is not commonly clear of ice till the beginning of the month of September, and perhaps ought, therefore, not to be chosen for an expedition having for its object to penetrate far to the eastward in this sea. Yugor Sound and the Kara Port are early free of fast ice, but instead, are long rendered difficult to navigate by considerable masses of drift ice, which are carried backwards and forwards in the bays on both sides of the sound by the currents which here alternate with the ebb and flow of the tide. Besides, at least in Yugor Sound, there are no good harbours, in consequence of which the drifting masses of ice may greatly inconvenience the vessels, which by these routes attempt to enter the Kara Sea. Matotschkin Sound, again, forms a channel nearly 100 kilometres long, deep and clear, with the exception of a couple of shoals, the position of which is known, which indeed is not usually free from fast ice until the latter half of July, but, on the other hand, in consequence of the configuration of the coast, is less subject to be obstructed by drift ice than the southern straits. There are good harbours at the eastern mouth of the sound. In 1875 and 1876 both the sound and the sea lying off it were completely open in the end of August, but the ice was much earlier broken up also on the eastern side, so that a vessel could without danger make its way among the scattered pieces of drift ice.

The part of Novaya Zemlya which is first visited by the walrus-hunters in spring is usually just the west coast off Matotschkin.

In case unusual weather does not prevail in the regions in question during the course of early and mid-summer, 1878—for instance, very steady southerly winds, which would early drive the drift ice away from the coast of the mainland—I consider, on the grounds which I have stated above, that it will be safest for the expedition to choose the course by Matotschkin Sound.

We cannot, however, reckon on having, so early as the beginning of August, open water *direct* to Port Dickson at the mouth of the Yenisej, but must be prepared to make a considerable detour towards the south in order to avoid the masses of drift ice, which are to be met with in the Kara Sea up to the beginning of September. The few days' delay which may be caused by the state of the ice here, will afford, besides, to the expedition an opportunity for valuable work in examining the natural history and hydrography of the channel, about 200 fathoms deep, which runs along the east coast of Novaya Zemlya. The Kara Sea is, in the other parts of it, not deep, but evenly shallow (ten to thirty fathoms), yet without being fouled by shoals or rocks. The most abundant animal life is found in the before-mentioned deep channel along the east coast, and it was from it that our two foregoing expeditions brought home several animal types, very peculiar and interesting in a systematic point of view. Near the coast the algæ, too, are rich and luxuriant. The coming expedition ought, therefore, to endeavour to reach Matotschkin Sound so early that at least seven days' scientific work may be done in those regions.

The voyage from the Kara Sea to Port Dickson is not attended, according to recent experience, with any difficulty. Yet we cannot reckon on arriving at Port Dickson sooner than from the 10th to the 15th August. In 1875 I reached this harbour with a sailing-vessel on the 15th August, after having been much delayed by calms in the Kara Sea. With a steamer it would have been possible to have reached the harbour, that year, in the beginning of the month. In 1876 the state of the ice was less favourable, in consequence of a cold summer and a prevalence of north-east winds, but even then I arrived at the mouth of the Yenisej on the 15th August.

It is my intention to lie to at Port Dickson, at least for some hours, in order to deposit letters on one of the neighbouring

islands in case, as is probable, I have no opportunity of meeting there some vessel sent out from Yeniseisk, by which accounts of the expedition may be sent home.

Actual observations regarding the hydrography of the coast between the mouth of the Yenisej and Cape Chelyuskin are for the present nearly wholly wanting, seeing that, as I have already stated, no large vessel has ever sailed from this neighbourhood. Even about the boat voyages of the Russians along the coast we know exceedingly little, and from their unsuccessful attempts to force a passage here we may by no means draw any unfavourable conclusion as to the navigability of the sea during certain seasons of the year. If, with a knowledge of the resources for the equipment of naval expeditions which Siberia now possesses, we seek to form an idea of the equipment of the Russian expeditions[1] sent out with extraordinary perseverance during the years 1734-1743 by different routes to the north coast of Siberia, the correctness of this assertion ought to be easily perceived. There is good reason to expect that a well-equipped steamer will be able to penetrate far beyond the point where they were compelled to return with their small but numerously manned craft, too fragile to encounter ice, and unsuitable for the open sea, being generally held together with willows.

There are, besides these, only three sea voyages, or perhaps more correctly coast journeys, known in this part of the Kara Sea, all under the leadership of the mates Minin and Sterlegoff. The first attempt was made in 1738 in a "double sloop," 70 feet long, 17 broad, and 7½ deep, built at Tobolsk and transported thence to the Yenisej by Lieutenant Owzyn. With this vessel Minin penetrated off the Yenisej to 72° 53′ N. L. Hence a jolly boat was sent farther towards the north, but it too was compelled, by want of provisions, to return before the point named by me, Port Dickson, was reached. The following year a new attempt was made, without a greater distance being traversed than the summer before. Finally in the year 1740 the Russians succeeded in reaching, with the double sloop already mentioned, 75° 15′ N. L., after having survived great dangers from a heavy

[1] A carefully written account of these voyages will be found in *Reise des Kaiserlich-russischen Flotten-Lieutenants Ferdinand von Wrangel längs der Nordküste von Siberien und auf dem Eismeere*, 1820-1824, bearbeitet von G. Engelhardt, Berlin, 1839; and G. P. Müller, *Voyages et Découvertes faites par les Russes le long des Côtes de la Mer Glaciale*, &c. Amsterdam: 1766.

sea at the river mouth. On the 2nd September, just as the most advantageous season for navigation in these waters had begun, they returned, principally on account of the lateness of the season.

There are, besides, two statements founded on actual observations regarding the state of the ice on this coast. For Middendorff, the Academician, during his famous journey of exploration in North Siberia, reached from land the sea coast at Tajmur Bay (75° 40′ N. L.), and *found the sea on the 25th August, 1843, free of ice as far as the eye could reach from the chain of heights along the coast.*[1] Middendorff, besides, states that the Yakoot Fomin, the only person who had passed a winter at Tajmur Bay, declared that the ice loosens in the sea lying off it in the first half of August, and that it is driven away from the beach by southerly winds, yet not further than that the edge of the ice can be seen from the heights along the coast.

The land between the Tajmur and Cape Chelyuskin was mapped by means of *sledge* journeys along the coast by mate Chelyuskin in the year 1742. It is now completely established that the northernmost promontory of Asia was discovered by him in the month of May in the year already mentioned, and at that time the sea in its neighbourhood was of course covered with ice. We have no observation as to the state of the ice during summer or autumn in the sea lying immediately to the west of Cape Chelyuskin; but, as the question relates to the possibility of navigating this sea, this is the place to draw attention to the fact that Prontschischev, on the 1st September, 1736, in an open sea, with coasting craft *from the east*, very nearly reached the north point of Asia, which is supposed to be situated in 77° 34′ N. Lat. and 105° E. Long., and that the Norwegian walrus-hunters during late autumn have repeatedly sailed far to the eastward from the north point of Novaya Zemlya (77° N. Lat., and 68° E. Long.), *without meeting with any ice.*

From what has been already stated, it is evident that for the present we do not possess any complete knowledge, founded on actual observations, of the hydrography of the stretch of coast between the Yenisej and Cape Chelyuskin. I, however, consider that during September, and possibly the latter half of August, we ought to be able to reckon with complete certainty on having here ice-free water, or at least a broad, open channel along the

[1] Th. von Middendorff, *Reise in dem äussersten Norden und Osten Siberiens*, vol. iv. I., pages 21 and 508 (1867).

coast, from the enormous masses of warm water, which the rivers Obi, Irtisch, and Yenisej, running up through the steppes of High Asia, here pour into the ocean, after having received water from a river territory, everywhere strongly heated during the month of August, and more extensive than that of all the rivers put together, which fall into the Mediterranean and the Black Seas.

Between Port Dickson and White Island, there runs therefore a strong fresh-water current, at first in a northerly direction. The influence which the rotation of the earth exercises, in these high latitudes, on streams which run approximately in the direction of the meridian, is, however, very considerable, and gives to those coming from the south an easterly bend. In consequence of this, the river water of the Obi and Yenisej must be confined as in a proper river channel, at first along the coast of the Tajmur country, until the current is allowed beyond Cape Chelyuskin to flow unhindered towards the north-east or east. Near the mouths of the large rivers I have, during calm weather in this current, in about 74° N. L., observed the temperature rising off the Yenisej to +9·4° C. (17th August, 1875), and off the Obi to +8° C. (10th August of the same year). As is usually the case, this current coming from the south produces both a cold under-current, which in stormy weather readily mixes with the surface water and cools it, and on the surface a northerly cold ice-bestrewn counter-current, which, in consequence of the earth's rotation, takes a bend to the west, and which evidently runs from the opening between Cape Chelyuskin and the northern extremity of Novaya Zemlya, towards the east side of this island, and perhaps may be the cause why the large masses of drift ice are pressed during summer against the east coast of Novaya Zemlya. According to my own experience and the uniform testimony of the walrus-hunters, *this ice melts away almost completely during autumn.*

In order to judge of the distance at which the current coming from the Obi and the Yenisej can drive away the drift ice, we ought to remember that even a very weak current exerts an influence on the position of the ice, and that, for instance, the current from the Plata River, whose volume of water, however, is not perhaps so great as that of the Obi and Yenisej, is still clearly perceptible at a distance of 1,500 kilomètres from the river mouth, that is to say, about three times as far as from Port Dickson to Cape Chelyuskin. The only bay which can be compared to the Kara Sea in respect of the area, which is

intersected by the rivers running into it, is the Gulf of Mexico.[1] The river currents from this bay appear to contribute greatly to the Gulf Stream.

The winds which, during the autumn months, often blow in these regions from the north-east, perhaps also, in some degree, contribute to keep a broad channel, along the coast in question, nearly ice-free.

The knowledge we possess regarding the navigable water to the east of Cape Chelyuskin towards the Lena, is mainly founded on the observations of the expeditions which were sent out by the Russian Government, before the middle of last century, to survey the northern part of Asia. In order to form a correct judgment of the results obtained, we must, while fully recognising the great courage, the extraordinary perseverance, and the power of bearing sufferings and overcoming difficulties of all kinds, which have always distinguished the Russian Polar explorers, always keep in mind that the voyages were carried out with small sailing-vessels of a build, which, according to modern requirements, is quite unsuitable for vessels intended for the open sea, and altogether too weak to stand collision with ice. They wanted, besides, not only the powerful auxiliary of our time, steam, but also a proper sail rig, fitted for actual manœuvring, and were for the most part manned with crews from the banks of the Siberian rivers, who never before had seen the water of the ocean, experienced a high sea, or tried sailing among sea ice. When the requisite attention is given to these circumstances, it appears to me that the voyages referred to below show positively that even here we ought to be able during autumn to reckon upon a navigable sea.

The expeditions along the coast, east of Cape Chelyuskin, started from the town Yakoutsk, on the bank of the Lena, in 62° N. L., upwards of 900 miles from the mouth of the river. Here also were built the vessels which were used for these voyages.

The first started in 1735, under the command of Marine-Lieutenant Prontschischev. After having sailed down the river, and passed, on the 14th August, the eastern mouth-arm of the Lena, he sailed round the large delta of the river. On the 7th September he had not got farther than to the mouth of the

[1] Compare von Middendorff, *Reise im Norden u. Osten Siberiens* (1848), part i., page 59, and a paper by von Baer, *Ueber das Klima des Tajmurlandes.*

Olonek. Three weeks had thus been spent in sailing a distance which an ordinary steamer ought now to be able to traverse in one day. Ice was seen, but not encountered. On the other hand, the voyage was delayed by contrary winds, probably blowing on land, whereby Prontschischev's vessel, if it had incautiously ventured out, would probably have been cast on the beach. The late season of the year induced Prontschischev to lay up his vessel for the winter here, at some summer yourts built by fur-hunters in 72° 54′ N. L. The winter passed happily, and the following year (1736) Prontschischev again broke up, as soon as the state of the ice in Olonek Bay permitted, which, however, was not until the 15th August. The course was shaped along the coast toward the north-west. Here drift ice was met with, but he nevertheless made rapid progress, so that on the 1st September he reached 77° 29′ N. L., as we now know, in the neighbourhood of Cape Chelyuskin. Compact masses of ice compelled him to turn here, and the Russians sailed back to the mouth of the Olonek, which was reached on the 15th September. The distinguished commander of the vessel had died shortly before of scurvy, and, some days after, his young wife, who had accompanied him on his difficult voyage, also died. As these attacks of scurvy did not happen during winter, but immediately after the close of summer, they form very remarkable contributions to a judgment of the way in which the Arctic expeditions of that period were fitted out.

A new expedition, under Marine-Lieutenant Chariton Laptev, sailed along the same coast in 1739. The Lena was left on the 1st August, and Cape Thaddeus (76° 47′ N. L.) reached on the 2nd September, the navigation having been obstructed by drift ice only off Chatanga Bay. Cape Thaddeus is situated only fifty or sixty English miles from Cape Chelyuskin. They turned here, partly on account of the masses of drift ice which barred the way, partly on account of the late season of the year, and wintered at the head of Chatanga Bay, which was reached on the 8th September. Next year Laptev attempted to return along the coast to the Lena, but his vessel was nipped by drift ice off the mouth of the Olonek. After many difficulties and dangers, all the men succeeded in reaching safely the winter quarters of the former year. Both from this point and from the Yenisej, Laptev himself and his second in command, Chelyuskin, and the surveyor, Tschekin, the following year made a number of sledge journeys, in order to survey the peninsula which projects farthest to the north-west from the mainland of Asia.

With this ended the voyages west of the Lena. The northernmost point of Asia, which was reached from land in 1742 by Chelyuskin, one of the most energetic members of most of the expeditions which we have enumerated, could not be reached by sea, and still less had any one succeeded in forcing his way with a vessel from the Lena to the Yenisej. Prontschischev had, however, turned on the 1st September, 1736, only some few minutes, and Laptev on the 2nd September, 1739, only about 50′ from the point named, after voyages in vessels, which clearly were altogether unsuitable for the purpose in view. Among the difficulties and obstacles which were met with during these voyages, not only ice, but also unfavourable and stormy winds played a prominent part. From fear of not being able to reach any winter station visited by natives, the explorers often turned at that season of the year when the Polar Sea is most open. With proper allowance for these circumstances, we may safely affirm that no serious obstacles to sailing round Cape Chelyuskin would probably have been met with in the years named, by any steamer properly fitted out for sailing among ice.

From the sea between the Lena and Behring's Straits there are much more numerous and complete observations than from that further west. The hope of obtaining tribute and commercial profit from the wild races living along the coast tempted the adventurous Russian hunters, even before the middle of the 17th century, to undertake a number of voyages along the coast. On a map which is annexed to the previously quoted work of Müller, founded mainly on researches in the Siberian archives, there is to be found a sea route pricked out with the inscription, "*Route anciennement fort fréquentée. Voyage fait par mer en* 1648 *par trois vaisseaux russes, dont un est parvenu jusqu'à la Kamschatka.*" [1]

Unfortunately the details of most of these voyages have been completely forgotten; and, that we have obtained some scanty accounts of one or other of them, has nearly always depended on some remarkable catastrophe, on lawsuits or other circumstances which led to the interference of the authorities. This is even the case with the most famous of these voyages, that of the Cossack, Deschnev, of which several accounts have been preserved, only through a dispute which arose between him and

[1] The map bears the title, "Nouvelle carte des découvertes faites par des vaisseaux Russiens, etc., dressée sur des mémoires authentiques de ceux qui ont assisté à ces découvertes, et sur d'autres connaissances dont on rend raison dans un mémoire séparé. St. Pétersbourg à l'Académie Impériale des Sciences, 1758."

one of his companions, concerning the right of discovery to a walrus bank on the east coast of Kamschatka. This voyage, however, was a veritable exploring expedition undertaken with the approval of the Government, partly for the discovery of some large islands in the Polar Sea, about which a number of reports were current among the hunters and natives, partly for extending the territory yielding tribute to the Russians, over the yet unknown regions in the north-east.

Deschnev started on the 1st July, 1648, from the Kolyma in command of one of the seven vessels (*Kotscher*),[1] manned with thirty men, of which the expedition consisted. Concerning the fate of four of these vessels we have no information. It is probable that they turned back, and were not lost, as several writers have supposed; three, under the command of the Cossacks, Deschnev and Ankudinov, and the fur-hunter, Kolmogorsov, succeeding in reaching Chutskojnos through what appears to have been open water. Here Ankudinov's vessel was shipwrecked; the men, however, were saved and divided among the other two, which were speedily separated. Deschnev continued his voyage along the east coast of Kamschatka to the Anadir, which was reached in October. Ankudinov is also supposed to have reached the mouth of the Kamschatka River, where he settled among the natives and finally died of scurvy.

The year following (1649) Staduchin sailed again, for seven days, eastward from the Kolyma to the neighbourhood of Chutskojnos, in an open sea, so far as we can gather from the defective account. Deschnev's own opinion of the possibility of navigating this sea may be seen from the fact, that, after his own vessel was lost, he had timber collected at the Anadir for the purpose of building new ones. With these he intended to send to Yakoutsk the tribute of furs which he had received from the natives. He was, however, obliged to desist from his project by an easily understood want of materials for the building of the new vessels; he remarks also in connection with this that the sea round Chutskojnos is not free of ice every year.

A number of voyages from the Siberian rivers northward, were also made after the founding of Nischni Kolymsk, by Michael Staduschin in 1644, in consequence of the reports which were current among the natives at the coast, of the existence of large inhabitated islands, rich in walrus tusks and mammoth bones,

[1] Pretty broad, flat-bottomed, keelless vessels, 12 fathoms long, generally moved forward by rowing; sail only used with fair wind (*Wrangels Reise*, p. 4).

in the Siberian Polar Sea. Often disputed, but persistently taken up by the hunting races, these reports have finally been verified by the discovery of the islands of New Siberia, of Wrangel's Land, and of the part of North America east of Behring's Straits, whose natural state gave occasion to the golden glamour of tradition with which the belief of the common people incorrectly adorned the bleak, treeless islands in the Polar Sea.

All these attempts to force a passage in the open sea from the Siberian coasts northwards, failed, for the single reason, that an open sea with a fresh breeze was as destructive to the craft which were at the disposal of the adventurous, but ill-equipped Siberian polar explorer as an ice-filled sea; indeed, more dangerous, for in the latter case the crew, if the vessel was nipped, generally saved themselves on the ice, and had only to contend with hunger, snow, cold, and other difficulties to which the most of them had been accustomed from their childhood; but in the open sea the ill-built, weak vessel, caulked with moss mixed with clay, and held together with willows, leaked already with a moderate sea, and with a heavier, was helplessly lost, if a harbour could not be reached in time of need.

The explorers soon preferred to reach the islands by sledge journeys on the ice, and thus at last discovered the whole of the large group of islands which is named New Siberia. The islands were often visited by hunters for the purpose of collecting mammoth tusks, of which great masses, together with the bones of the mammoth, rhinoceros, sheep, ox, horse, etc., are found imbedded in the beds of clay and sand here. Afterwards they were completely surveyed during Hedenström's expeditions, fitted out by Count Rumänzov, Chancellor of the Russian Empire, in the years 1809-1811, and during Lieutenant Anjou's in 1823. Hedenström's expeditions were carried out by travelling with dog-sledges on the ice, before it broke, to the islands, passing the summer there, and returning in autumn, when the sea was again covered with ice. As the question relates to the possibility of navigating this sea, these expeditions, carried out in a very praiseworthy way, might be expected to have great interest, especially through observations from land, concerning the state of the ice in autumn; but in the short account of Hedenström's expeditions which is inserted in Wrangel's *Travels*, pp. 99-119, the only source accessible to me in this respect, there is not a single word on this point.[1] Information on this subject, so important

[1] Wrangel's own journeys were carried out during winter, with dog sledges on the ice, and, however interesting in many other respects, do not

for our expedition, has, however, by Mr. Sibiriakoff's care, been received from inhabitants of North Siberia, who earn their living by collecting mammoths' tusks on the group of islands in question. By these accounts the sea between the north coast of Asia and the islands of New Siberia, is every year pretty free of ice.

A very remarkable discovery was made in 1811 by a member of Hedenström's expedition, the Yakoutsk townsman Sannikov; for he found, on the west coast of the island Katelnoj, remains of a roughly-timbered winter habitation, in the neighbourhood of the wreck of a vessel, differing completely in build from those which are common in Siberia. Partly from this, partly from a number of tools which lay scattered on the beach, Sannikov drew the conclusion, that a hunter from Spitzbergen or Novaya Zemlya had been driven thither by the wind, and had lived there for a season with his crew. Unfortunately the inscription on a monumental cross in the neighbourhood of the hut was not translated.

During the great northern expeditions,[1] several attempts were also made to force a passage eastwards from the Lena. The first was under the command of Lieutenant Lassinius in 1735. He left the most easterly mouth-arm of the Lena on the 21st of August, and sailed 120 versts eastward, and there encountered drift ice which compelled him to seek a harbour at the coast. Here the winter was passed, with the unfortunate result, that the chief himself, and most of the fifty-two men belonging to the expedition, perished of scurvy.

The following year, 1736, there was sent out, in the same direction, a new expedition under Lieutenant Dmitri Laptev. With the vessel of Lassinius he attempted, in the middle of August, to sail eastward, but he soon fell in with a great deal of drift ice. So soon as the end of the month—the time when navigation ought properly to begin—he turned towards the Lena on account of ice.

In 1739 Laptev undertook his third voyage. He penetrated to the mouth of the Indigirka, which was frozen over on the 21st September, and wintered there. The following year the voyage was continued somewhat beyond the mouth of the

yield any other direct contribution to our knowledge of the state of the ice in summer and autumn.

[1] This is a common name for the many Russian expeditions which, during the years 1734-1743, were sent into the North Polar Sea from the Dwina, Obi, Yenisej, Lena, and Kamschatka.

Kolyma to Cape Great Baranov, where further advance was prevented by drift ice on the 26th September. After having returned to the Kolyma, and wintered at Nischni Kolymsk, he attempted, the following year, again to make his way eastwards in some large boats built during winter, but, on account of fog, contrary winds, and ice, without success. In judging of the results these voyages yielded, we must take into consideration the utterly unsuitable vessels in which they were undertaken—at first in a double sloop, built at Yakoutsk, in 1735, afterwards in two large boats built at Nischni Kolymsk. If we may judge of the nature of these craft from those now used on the Siberian rivers, we ought rather to be surprised that any of them could venture out on a real sea, than consider the unsuccessful voyages just described as proofs that there is no probability of being able to force a passage here with a vessel of modern build, and provided with steam power.

It remains, finally, for me to give an account of the attempts that have been made to penetrate westward from Behring's Straits.

Deschnev's voyage, from the Lena, through Behring's Straits to the mouth of the Anadir, in 1648, became completely forgotten in the course of about a century, until Müller, by searches in the Siberian archives, recovered the details of these and various other voyages along the north coast of Siberia. That the memory of these remarkable voyages has been preserved to after-times, however, depends, as has been already stated, upon accidental circumstances, lawsuits, and such like, which led to correspondence with the authorities. Of other similar undertakings we have certainly no knowledge, although now and then we find it noted that the Polar Sea had in former times often been traversed. In accounts of the expeditions fitted out by the authorities, it, for instance, often happens that mention is made of meeting with hunters and traders, who were sailing along the coast in the prosecution of private enterprise. Little attention was, however, given to these voyages, and, eighty-one years after Deschnev's voyage, the existence of straits between the north-eastern extremity of Asia and the north-western extremity of America was quite unknown, or at least doubted. Finally, in 1729, Behring anew sailed through the Sound, and attached his name to it. He did not sail, however, very far (to 172° W. Long.) along the north coast of Asia, although he does not appear to have met with any obstacle from ice. Nearly fifty years afterwards Cook concluded in these waters the series of splendid discoveries with which he enriched geographical

science. After having, in 1778, sailed a good way eastwards along the north coast of America, he turned towards the west, and reached the 180th degree of longitude on the 29th August: the fear of meeting with ice deterred him from sailing further westward, and his vessel appears to have scarcely been equipped or fitted for sailing among ice.

After Cook's time we know of only three expeditions which have sailed westwards from Behring's Straits. The first was an American expedition, under Captain Rodgers, in 1855. He reached, through what appears to have been open water, the longitude of Cape Yakan (176° E. from Greenwich). The second was that of the English steam-whaler Long, who, in 1867, in search of a new profitable whale-fishing ground, sailed further west than any before him. By the 10th August he had reached the longitude of Tschaun Bay (170° E. from Greenwich). He was engaged in whale-fishing, not in an exploring expedition, and turned here; but, in the short account he has given of his voyage, he expresses the decided conviction that a voyage from Behring's Straits to the Atlantic belongs to the region of possibilities, and adds that, even if this sea-route does not come to be of any commercial importance, that between the Lena and Behring's Straits ought to be useful for turning to account the products of Northern Siberia.[1] Finally, last year a Russian expedition was sent out to endeavour to reach Wrangel's Land from Behring's Straits. According to communications in the newspapers, it was prevented by ice from sailing thence, as well as from sailing far to the west.

Information has been obtained through Mr. Sibiriakoff, from North Siberia, regarding the state of the ice in the neighbouring sea. The hunting in these regions appears to have now fallen off so seriously, that only few persons were found who could give any answers to the questions put.

Thus in Yakoutsk there was only one man (a priest) who had been at the coast of the Polar Sea. He states that when the wind blows off the land the sea becomes free of ice, but that the ice comes back when the wind blows on to the land, and thereby exposes the vessels which cannot reach a safe harbour to great danger.

Another correspondent states, on the ground of observations made during Tschikanovski's expedition, that in 1875 the sea off the Olonek was *completely* free of ice, but adds at the same time that the year in this respect was an exceptional one.

[1] *Petermann's Mittheilungen*, 1868, p. 1, and 1869, p. 32.

The Arctic Ocean, not only in summer, but also during winter, is *occasionally* free of ice, and at a distance of 200 versts from the coast, the sea is open even in winter, in what direction, however, is uncertain. The latter fact is also confirmed by Wrangel's journeys with dog-sledges on the ice in 1821-1823.

A third person says, "According to the information which I have received, the north coast, from the mouth of the Lena to that of the Indigirka, is free from ice from July to September. The north wind drives the ice towards the coast, but not in large masses. According to the observations of the men who search for mammoth tusks, the sea is open as far as the southern part of the New Siberia Islands. It is probable that these islands form a protection against the ice in the Werchnojan region. It is otherwise on the Kolyma coast; and if the Kolyma can be reached from Behring's Straits, so certainly can the Lena."

The circumstance that the ice during summer is driven from the coast by southerly winds, yet not so far but that it returns, in larger or smaller quantity, with northerly winds, is further confirmed by other correspondents, and appears to me to show that the New Siberian Islands and Wrangel's Land only form links in an extensive group of islands, running parallel with the north coast of Siberia, which, on the one hand, keeps the ice from the intermediate sea from drifting away altogether, and favours the formation of ice during winter, but, on the other hand, protects the coast from the Polar ice proper, formed to the north of the islands. The information I have received besides, refers principally to the summer months. As in the Kara Sea, which formerly had a yet worse reputation, the ice here, too, perhaps, melts away for the most part during autumn, so that at this season we may reckon on a pretty open sea.

Most of the correspondents, who have given information about the state of the ice in the Siberian Polar Sea, concern themselves further with the reports current in Siberia, that American whalers have been seen from the coast far to the westward. The correctness of these reports was always denied in the most decided way; yet they rest, at least to some extent, on a basis of fact. For I have myself met with a whaler, who for three years in a steamer carried on trade with the inhabitants of the coast from Cape Yakan to Behring's Straits. He was quite convinced that some years at least it would be possible to sail from Behring's Straits to the Atlantic. On one occasion he had returned through Behring's Straits as late as the 17th October.

From what I have thus stated, it follows,—

That the ocean lying north of the north coast of Siberia, between the mouth of the Yenisej and Tschaun Bay, has never been ploughed by the keel of any proper sea-going vessel, still less been traversed by any steamer specially fitted out for navigation among ice:

That the small vessels with which it has been attempted to traverse this part of the ocean never ventured very far from the coast:

That an open sea, with a fresh breeze, was . estructive for them, indeed more destructive, than a sea · ered with drift ice:

That they almost always sought some convenient winter harbour, just at that season of the year when the sea is freest of ice, namely, late summer or autumn:

That, notwithstanding the sea from Cape Chelyuskin to Behring's Straits has been repeatedly traversed, no one has yet succeeded in sailing over the whole extent at once:

That the covering of ice formed during winter along the coast, but probably not in the open sea, is every summer broken up, giving origin to extensive fields of drift ice, which are driven, now by a northerly wind towards the coast, now by a south wind out to sea, yet not so far but that it comes back to the coast after some days' northerly wind; whence it appears probable that the Siberian Sea is, so to say, shut off from the Polar Sea proper, by a series of islands, of which, for the present, we know only Wrangel's Land and the islands which form New Siberia.

In this connection it seems to me probable that a well-equipped steamer would be able without meeting too many difficulties, at least obstacles from ice, to force a passage this way during autumn in a few days, and thus not only solve a geographical problem of several centuries' standing, but also, with all the means that are now at the disposal of the man of science in researches in geography, hydrography, geology, and natural history, survey a hitherto almost unknown sea of enormous extent.

The sea north of Behring's Straits is now visited by hundreds of whaling steamers, and the way thence to American and European harbours therefore forms a much-frequented route. Some few decades back, this was, however, by no means the case. The voyages of Behring, Cook, Kotzebue, Beechey, and others were then considered as adventurous, fortunate exploring expeditions of great value and importance in respect of science,

but without any direct practical utility. For nearly a hundred and fifty years the same was the case with Spangberg's voyage from Kamschatka to Japan in the year 1739, by which the exploring expeditions of the Russians, in the northernmost part of the Pacific Ocean, were connected with those of the Dutch and the Portuguese to India and Japan; and in case our expedition succeeds in reaching the Suez Canal, after having circumnavigated Asia, there will meet us there a splendid work, which, more than any other, reminds us, that what to-day is declared by experts to be impossible, is often carried into execution to-morrow.

I am also fully convinced that it is not only possible to sail along the north coast of Asia, provided circumstances are not too unfavourable, but that such an enterprise will be of incalculable practical importance, by no means directly, as opening a new commercial route, but indirectly, by the impression which would thereby be communicated of the practical utility of a communication by sea between the ports of North Scandinavia and the Obi and Yenisej, on the one hand, and between the Pacific Ocean and the Lena on the other.

Should the expedition, contrary to expectation, not succeed in carrying out the programme which has been arranged in its entirety, it ought not to be looked upon as having failed. In such a case the expedition will remain for a considerable time at places on the north coast of Siberia, suitable for scientific research. Every mile beyond the mouth of the Yenisej is a step forward to a complete knowledge of our globe—an object which sometime or other must be attained, and towards which it is a point of honour for every civilised nation to contribute in its proportion.

Men of science will have an opportunity, in these hitherto unvisited waters, of answering a number of questions regarding the former and present state of the Polar countries, of which more than one is of sufficient weight and importance to lead to such an expedition as the present. I may be permitted here to refer to only a few of these.

If we except that part of the Kara Sea which has been surveyed by the two last Swedish expeditions, we have for the present no knowledge of the vegetable and animal life in the sea which washes the north coast of Siberia. Quite certainly we shall here, in opposition to what has been hitherto supposed, meet with the same abundance of animals and plants as in the sea round Spitzbergen. In the Siberian Polar sea, the animal and vegetable types, so far as we can judge beforehand, exclusively

consist of survivals from the glacial period, which next preceded the present, which is not the case in the Polar Sea, where the Gulf Stream distributes its waters, and whither it thus carries types from more southerly regions. But a complete and exact knowledge of which animal types are of glacial, and which of Atlantic origin, is of the greatest importance, not only for zoology and the geography of animals, but also for the geology of Scandinavia, and especially for the knowledge of our loose earthy layers.

Few scientific discoveries have so powerfully captivated the interest, both of the learned and unlearned, as that of the colossal remains of elephants, sometimes well preserved, with flesh and hair, in the frozen soil of Siberia. Such discoveries have more than once formed the object of scientific expeditions, and careful researches by eminent men; but there is still much that is enigmatical with respect to a number of circumstances connected with the mammoth period of Siberia, which *perhaps* was contemporaneous with our glacial period. Specially is our knowledge of the animal and vegetable types, which lived contemporaneously with the mammoth, exceedingly incomplete, although we know that in the northernmost parts of Siberia, which are also most inaccessible from land, there are small hills covered with the bones of the mammoth and other contemporaneous animals, and that there is found everywhere in that region so-called Noah's wood, that is to say, half-petrified or carbonised vegetable remains from several different geological periods.

Taking a general view of the subject, we see that an investigation, as complete as possible, of the geology of the Polar countries, so difficult of access, is a condition indispensable to a knowledge of the former history of our globe. In order to prove this I need only point to the epoch-making influence which has been exerted on geological theories by the discovery, in the rocks and earthy layers of the Polar countries, of beautiful fossil plants from widely separated geological periods. In this field too our expedition to the north coast of Siberia ought to expect to reap abundant harvests. There are besides to be found in Siberia, strata which have been deposited almost contemporaneously with the coal-bearing formations of South Sweden, and which therefore contain animal and vegetable petrifications which just now are of very special interest for geological science in our own country, with reference to the discoveries of splendid fossil plants which of late years have been made at several places among us, and give us so lively an idea of the sub-tropical vegetation which in former times covered the Scandinavian peninsula.

Few sciences perhaps will yield so important practical results as meteorology is likely to do at some future date—a fact, or rather an already partly realised expectation, which has won general recognition, as is shown by the large sums which in all civilised countries have been set apart for establishing meteorological offices and for encouraging meteorological research. But the state of the weather in a country is so dependent on the temperature, wind, pressure of the air, etc., in very remote regions that the laws of the meteorology of a country can only be ascertained by comparing observations from the most distant regions. Several international meteorological enterprises have already been started, and we may almost consider the meteorological institutions of the different countries as separate departments of one and the same office, distributed over the whole world, through whose harmonious co-operation the object in view shall one day be reached. But, beyond the places for which daily series of observations may be obtained, there are regions hundreds of square miles in extent from which no observations, or only scattered ones, are yet to be had, and here notwithstanding we have just the key to many meteorological phenomena, otherwise difficult of explanation, within the civilised countries of Europe. Such a meteorological territory, unknown, but of the greatest importance, is formed by the Polar Sea lying to the north of Siberia, and the land and islands there situated. It is of great importance for the meteorology of Europe and of Sweden to obtain trustworthy accounts of the distribution of the land, of the state of the ice, the pressure of the air, and the temperature in that in these respects little-known part of the globe, and the Swedish expedition will here have a subject for investigation of direct importance for our own country.

To a certain extent the same may be said of the contributions which may be obtained from those regions to our knowledge of terrestrial magnetism, of the aurora, etc. There are, besides, the examination of the flora and fauna in those countries, hitherto unknown in this respect, ethnographical researches, hydrographical work, etc.

I have of course only been able to notice shortly the scientific questions which will meet the expedition during a stay of some length on the north coast of Siberia, but what has been said may perhaps be sufficient to show that the expedition, even if its geographical objects were not attained, ought to be a worthy continuation of similar enterprises which have been set on foot in this country, and which have brought gain to science and honour to Sweden.

Should the expedition again, as I hope, be able to reach Behring's Straits with little hindrance, and thus in a comparatively short time—in that case indeed the time, which on the way can be devoted to researches in natural history, will be quite too short for solving many of the scientific questions I have mentioned. But without reckoning the world-historical navigation problem which will then be solved, extensive contributions of immense importance ought also to be obtainable regarding the geography, hydrography, zoology, and botany of the Siberian Polar Sea, and, beyond Behring's Straits, the expedition will meet with other countries having a more luxuriant and varied nature, where other questions which perhaps concern us less, but are not on that account of less importance for science as a whole, will claim the attention of the observer and yield him a rich reward for his labour and pains. These are the considerations which formed the grounds for the arrangement of the plan of the expedition which is now in question.

It is my intention to leave Sweden in the beginning of July, 1878, in a steamer, specially built for navigation among ice, which will be provisioned for two years at most, and which, besides a scientific staff of four or five persons, will have on board a naval officer, a physician, and at most eighteen men—petty officers and crew, preferably volunteers, from your Royal Majesty's navy. Four walrus-hunters will also be hired in Norway. The course will be shaped at first to Matotschkin Sound, in Novaya Zemlya, where a favourable opportunity will be awaited for the passage of the Kara Sea. Afterwards the voyage will be continued to Port Dickson, at the mouth of the Yenisej, which I hope to be able to reach in the first half of August. As soon as circumstances permit, the expedition will continue its voyage from this point in the open channel which the river-water of the Obi and the Yenisej must indisputably form along the coast to Cape Chelyuskin, possibly with some short excursions towards the north-west in order to see whether any large island is to be found between the northern part of Novaya Zemlya and New Siberia.

At Cape Chelyuskin the expedition will reach the only part of the proposed route which has not been traversed by some small vessel, and this place is perhaps rightly considered as that which it will be most difficult for a vessel to double during the whole north-east passage. As Prontschischev, in 1736, in small river craft built with insufficient means reached within a few minutes of this north-westernmost promontory of

Asia, our vessel, equipped with all modern appliances, ought not to find insuperable difficulties in doubling this point, and if that be accomplished, we will probably have pretty open water towards Behring's Straits, which ought to be reached before the end of September.

If time, and the state of the ice permit, it would be desirable that the expedition during this voyage should make some excursions towards the north, in order to ascertain whether land is not to be found between Cape Chelyuskin and the New Siberian group of islands, and between it and Wrangel's Land. From Behring's Straits the course will be shaped, with such stoppages as circumstances give rise to, for some Asiatic port, from which accounts may be sent home, and then onwards round Asia to Suez. Should the expedition be prevented from forcing a passage east of Cape Chelyuskin, it will depend on circumstances which it is difficult to foresee, whether it will immediately return to Europe, in which case the vessel with its equipment and crew may be immediately available for some other purpose, or whether it ought not to winter in some suitable harbour in the bays at the mouths of the Tajmur, Pjäsina, or Yenisej. Again, in case obstacles from ice occur east of Cape Chelyuskin, a harbour ought to be sought for at some convenient place on the north coast of Siberia, from which, during the following summer, opportunities would be found for important surveys in the Polar Sea, and during the course of the summer some favourable opening will also certainly occur, when southerly winds have driven the ice from the coast, for reaching Behring's Straits. Probably also, if it be necessary to winter, there will be opportunities of sending home letters from the winter station.

CHAPTER I.

Departure—Tromsoe—Members of the Expedition—Stay at Maosoe—Limit of Trees—Climate—Scurvy and Antiscorbutics—The first doubling of North Cape—Othere's account of his Travels—Ideas concerning the Geography of Scandinavia current during the first half of the sixteenth century—The oldest Maps of the North—Herbertstein's account of Istoma's voyage — Gustaf Vasa and the North-east Passage — Willoughby and Chancelor's voyages.

THE *Vega* left the harbour of Karlskrona on the 22nd June, 1878. Including Lieutenants Palander and Brusewitz, there were then on board nineteen men belonging to the Swedish navy, and two foreign naval officers, who were to take part in the expedition—Lieutenants Hovgaard and Bove. The two latter had lived some time at Karlskrona in order to be present at the fitting out and repairing of the vessel.

On the 24th June the *Vega* called at Copenhagen in order to take on board the large quantity of provisions which had been purchased there. On the 26th June the voyage was resumed to Gothenburg, where the *Vega* anchored on the 27th. During the passage there was on board the famous Italian geographer, Commendatore CHRISTOFORO NEGRI, who, for several years back, had followed with special interest all Arctic voyages, and now had received a commission from the Government of his native country to be present at the departure of the *Vega* from

TROMSOE.

After a photograph by Claus Knudsen, Christiania.

Sweden, and to make himself acquainted with its equipment, &c. At Gothenburg there embarked Docent Kjellman, Dr. Almquist, Dr. Stuxberg, Lieutenant Nordquist, and an assistant to the naturalists, who had been hired in Stockholm; and here were taken on board the greater part of the scientific equipment of the expedition, and various stocks of provisions, clothes, &c., that had been purchased in Sweden.

On the 4th July the *Vega* left the harbour of Gothenburg. While sailing along the west coast of Norway there blew a fresh head wind, by which the arrival of the vessel at Tromsoe was delayed till the 17th July. Here I went on board. Coal, water, reindeer furs [1] for all our men, and a large quantity of other stores, bought in Finmark for the expedition, were taken in here; and three walrus-hunters, hired for the voyage, embarked.

On the 21st July the whole equipment of the *Vega* was on board, the number of its crew complete, all clear for departure, and the same day at 2.15 P.M. we weighed anchor, with lively hurrahs from a numerous crowd assembled at the beach, to enter in earnest on our Arctic voyage.

[1] In many Polar expeditions, sealskin has been used as clothing instead of reindeer skin. The reindeer skin, however, is lighter and warmer, and ought therefore to have an unconditional preference as a means of protection against severe cold. In mild weather, clothing made of reindeer skin in the common way has indeed the defect that it is drenched through with water, and thereby becomes useless, but in such weather it is in general unnecessary to use furs. The coast Chukchis, who catch great numbers of seals, but can only obtain reindeer skins by purchase, yet consider clothing made of the latter material indispensable in winter. During this season they wear an overcoat of the same form as the Lapps' *pesk*, the suitableness of whose cut thus appears to be well proved. On this account I prefer the old-world Polar dress to that of the new, which consists of more closely fitting clothes. The Lapp shoes of reindeer skin (*renskallar*, *komager*) are, on the other hand, if one has not opportunity to change them frequently, nor time to take sufficient care of them, quite unserviceable for Arctic journeys.

The members of the expedition on board the *Vega* were—

A. E. Nordenskiöld, Professor, in command of the expedition	born	18th Nov. 1832
A. A. L. Palander, Lieutenant, now Captain in the Royal Swedish Navy, chief of the steamer *Vega*	,,	2nd Oct. 1840
F. R. Kjellman, Ph.D., Docent in Botany in the University of Upsala, superintendent of the botanical work of the expedition	,,	4th Nov. 1846
A. J. Stuxberg, Ph.D., superintendent of the zoological work	,,	18th April 1849
E. Almquist, Candidate of Medicine, medical officer of the expedition, lichenologist	,,	8th Aug. 1852
E. C. Brusewitz, Lieutenant in the Royal Swedish Navy, second in command of the vessel	,,	1st Dec. 1844
G. Bove, Lieutenant in the Royal Italian Navy, superintendent of the hydrographical work of the expedition	,,	23rd Oct. 1853
A. Hovgaard, Lieutenant in the Royal Danish Navy, superintendent of the magnetical and meteorological work of the expedition	,,	1st Nov. 1853
O. Nordquist, Lieutenant in the Imperial Russian Regiment of Guards, interpreter, assistant zoologist	,,	20th May 1858
R. Nilsson, sailing-master	,,	5th Jan. 1837
F. A. Pettersson, first engineer	,,	3rd July 1835
O. Nordström, second engineer	,,	24th Feb. 1855
C. Carlström, fireman	,,	14th Dec. 1845
O. Ingelsson, fireman	,,	2nd Feb. 1849
O. Oeman, seaman	,,	23rd April 1843
G. Carlsson, seaman	,,	22nd Sep. 1843
C. Lundgren, seaman	,,	5th July 1851
O. Hansson, seaman	,,	6th April 1856
D. Asplund, boatswain, cook	,,	28th Jan. 1827
C. J. Smaolaenning, boatswain	,,	27th Sep. 1839
C. Levin, boatswain, steward	,,	24th Jan. 1844
P. M. Lustig, boatswain	,,	22nd April 1845
C. Ljungström, boatswain	,,	12th Oct. 1845
P. Lind, boatswain	,,	15th Sep. 1856

P. O. Faeste, boatswain	born 23rd Sep. 1856
S. Andersson, carpenter	„ 3rd Sep. 1847
J. Haugan, walrus-hunter[1]	„ 23rd Jan. 1825
P. Johnsen, walrus-hunter	„ 15th May 1845
P. Sivertsen, walrus-hunter	„ 2nd Jan. 1853
Th. A. Boström, assistant to the scientific men	„ 21st Sep. 1857

There was also on board the *Vega* during the voyage from Tromsoe to Port Dickson, as commissioner for Mr. Sibiriakoff, Mr. S. J. Serebrenikoff, who had it in charge to oversee the taking on board and the landing of the goods that were to be carried to and from Siberia in the *Fraser* and *Express*. These vessels had sailed several days before from Vardoe to Chaborova in Yugor Schar, where they had orders to wait for the *Vega*. The *Lena*, again, the fourth vessel that was placed at my disposal, had, in obedience to orders, awaited the *Vega* in the harbour of Tromsoe, from which port these two steamers were now to proceed eastwards in company.

After leaving Tromsoe, the course was shaped at first within the archipelago to Maosoe, in whose harbour the *Vega* was to make some hours' stay, for the purpose of posting letters in the post-office there, probably the most northerly in the world. But during this time so violent a north-west wind began to blow, that we were detained there three days.

Maosoe is a little rocky island situated in 71° N. L., thirty-two kilometres south-west from North Cape, in a region abounding in fish, about halfway between Bred Sound and Mageroe Sound. The eastern coast of the island is indented by a bay, which forms a well-protected harbour. Here, only a few kilometres south of the northernmost promontory of Europe, are to be found, besides a large number of fishermen's huts, a church, shop, post-office, hospital, &c.; and I need scarcely add, at

[1] Haugan had formerly for a long series of years carried his own vessel to Spitzbergen and Novaya Zemlya, and was known as one of the most fortunate walrus-hunters of the Norwegian Polar Sea fleet.

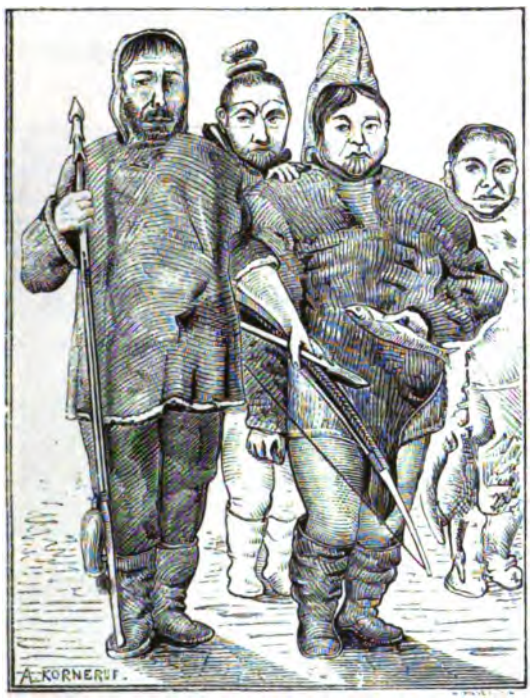
least for the benefit of those who have travelled in the north of Norway, several friendly, hospitable families in whose society we talked away many hours of our involuntary stay in the neighbourhood. The inhabitants of course live on fish. All

OLD-WORLD POLAR DRESS.

Lapp, after original in the Northern Museum, Stockholm.

agriculture is impossible here. Potatoes have indeed sometimes yielded an abundant crop on the neighbouring Ingoe (71° 5′ N. L.), but their cultivation commonly fails, in consequence of the shortness of the summer; on the other hand, radishes and a number of other vegetables are grown with success in the garden-beds. Of wild berries there is found here

the red whortleberry, yet in so small quantity that one can seldom collect a quart or two: the bilberry is somewhat more plentiful; but the grapes of the north, the cloudberry (*multer*), grow in profuse abundance. From an area of several square



NEW-WORLD POLAR DRESS.

Greenlanders, after an old painting in the Ethnographical Museum, Copenhagen.[1]

[1] The original of this drawing, for which I am indebted to Councillor of Justice H. Rink, of Copenhagen, was painted by a German painter at Bergen, in 1654. The painting has the following inscription:—

Mit Lebern Schifflein auff dem Meer
De grönleinder fein hein undt her
Von Thieren undt Vögelen haben see Ire Tracht
Das kalte Lands von Winter nacht.

fathoms one can often gather a couple of quarts. There is no wood here—only bushes.

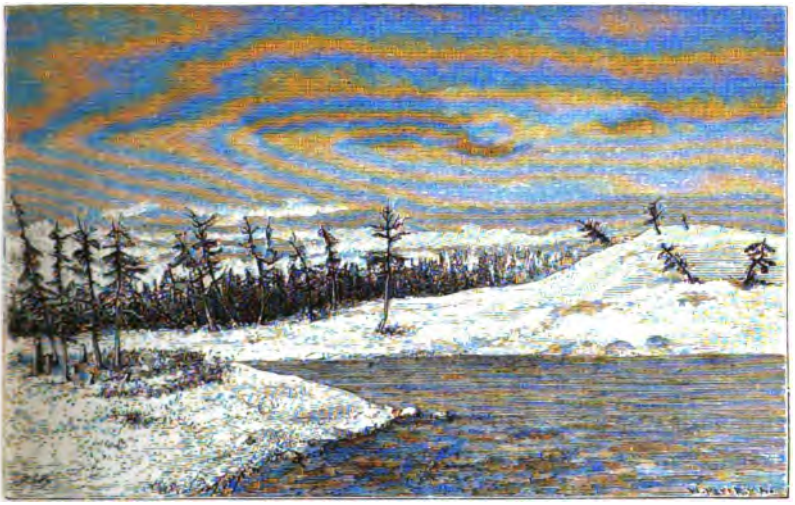
In the neighbourhood of North Cape, the wood, for the present, does not go quite to the coast of the Polar Sea, but at sheltered places, situated at a little distance from the beach, birches,[1] three to four metres high, are already to be met with. In former times, however, the outer archipelago itself was

LIMIT OF TREES IN NORWAY.
At Præstevandet, on Tromsoen, after a photograph.

covered with trees, which is proved by the tree-stems, found imbedded in the mosses on the outer islands on the coast of

[1] The birch which grows here is the sweet-scented birch (*Betula odorata*, Bechst.), not the dwarf birch (*Betula nana*, L.), which is found as far north as Ice Fjord in Spitzbergen (78° 7′ N. L.), though there it only rises a few inches above ground.

Finmark, for instance, upon Renoe. In Siberia the limit of trees runs to the beginning of the estuary delta, *i.e.*, to about 72° N. L.[1] As the latitude of North Cape is 71° 10′, the wood in Siberia at several places, viz., along the great rivers, goes considerably farther north than in Europe. This depends partly on the large quantity of warm water which these rivers, in summer, carry down from the south, partly on the transport of seeds with the river water, and on the more favourable soil,



LIMIT OF TREES IN SIBERIA.
At Boganida, after Middendorf.

which consists of a rich mould, yearly renewed by inundations, but in Norway again for the most part of rocks of granite and gneiss or of barren beds of sand. Besides, the limit of trees has a quite dissimilar appearance in Siberia and Scandinavia :

[1] According to Latkin, *Die Lena und ihr Flussgebiet* (*Petermann's Mittheilungen*, 1879, p. 91). On the map which accompanies Engehardt's reproduction of Wrangel's *Journey* (Berlin, 1839), the limit of trees at the Lena is placed at 71° N. L.

in the latter country, the farthest outposts of the forests towards the north consist of scraggy birches, which, notwithstanding their stunted stems, clothe the mountain sides with a very lively and close green; while in Siberia the outermost trees are

THE CLOUDBERRY (RUBUS CHAMMMORUS, L.).
Fruit of the natural size. Flowering stalks diminished.

gnarled and half-withered larches (*Larix dahurica*, Turcz.), which stick up over the tops of the hills like a thin grey brush.[1] North of this limit there are to be seen on the Yenisej

[1] On the Kola Peninsula, and in the neighbourhood of the White Sea, as far as to Ural, the limit of trees consists of a species of pine (*Picea*

luxuriant bushes of willow and alder. That in Siberia too, the large wood, some hundreds or thousands of years ago, went farther north than now, is shown by colossal tree-stumps found still standing in the *tundra*, nor is it necessary now to go far south of the extreme limit, before the river banks are to be seen crowned with high, flourishing, luxuriant trees.

The climate at Maosoe is not distinguished by any severe winter cold,[1] but the air is moist and raw nearly all the year round. The region would however be very healthy, did not scurvy, especially in humid winters, attack the population, educated and uneducated, rich and poor, old and young. According to a statement made by a lady resident on the spot, very severe attacks of scurvy are cured without fail by preserved

obovata, Ledeb.), but farther east in Kamschatka again of birch.—Th. von Middendorff, *Reise in dem äussersten Norden und Osten Sibiriens*, vol. iv. p. 582.

[1] An idea of the influence exerted by the immediate neighbourhood of a warm ocean-current in making the climate milder may be obtained from the following table of the mean temperatures of the different months at 1. Tromsoe (69° 30′ N. L.); 2. Fruholm, near North Cape (71° 6′ N. L.); 3. Vardoe (70° 22′ N. L.); 4. Enontekis and Karesuando, on the river Muonio, in the interior of Lapland (68° 26′ N. L.).

	Tromsoe.	*Fruholm.*	*Vardoe.*	*Enontekis*
January	− 4·2°	−2 7°	−6·0°	−13·7°
February	− 4·0	−4·7	−6·4	−17·1
March	− 3·8	−3·2	−5·1	−11·4
April	− 0·1	−0·9	−1·7	− 6·0
May	+ 3·2	+2·7	+1·8	+ 0·9
June	+ 8·7	+7·5	+5·9	+ 8·0
July	+11·5	+9·3	+8·8	+11·6
August	+10·4	+9·9	+9·8	+12·0
September	+ 7·0	+5·8	+6·4	+ 4·5
October	+ 2·0	+2·5	+1·3	− 4·0
November	− 1·7	−1·1	−2·1	− 9·9
December	− 3·2	−1·9	−4·0	−11·3

The figures are taken from H. Mohn's *Norges Klima* (reprinted from C. F. Schubeler's *Væxtlivet i Norge*, Christiania, 1879), and A. J. Ångström, *Om lufttemperaturen i Enontekis* (Öfvers. af Vet. Akad. Förhandl., 1860).

cloudberries and rum. Several spoonfuls are given to the patient daily, and a couple of quarts of the medicine is said to be sufficient for the complete cure of children severely attacked by the disease. I mention this new method of using the cloudberry, the old well-known antidote to scurvy, because I am convinced that future Polar expeditions, if they will avail themselves of the knowledge of this cure, will find that it conduces to the health and comfort of all on board, and that the medicine is seldom refused, unless it be by too obstinate abstainers from spirituous liquors.

It enters into the plan of this work, as the *Vega* sails along, to give a brief account of the voyages of the men who first opened the route along which she advances, and who thus, each in his measure, contributed to prepare the way for the voyage whereby the passage round Asia and Europe has now at last been accomplished. On this account it is incumbent on me to begin by giving a narrative of the voyage of discovery during which the northernmost point of Europe was first doubled, the rather because this narrative has besides great interest for us, as containing much remarkable information regarding the condition of the former population in the north of Scandinavia.

This voyage was accomplished about a thousand years ago by a Norwegian, OTHERE, from Halogaland or Helgeland, that part of the Norwegian coast which lies between 65° and 66° N. L. Othere, who appears to have travelled far and wide, came in one of his excursions to the court of the famous English king, Alfred the Great. In presence of this king he gave, in a simple, graphic style, a sketch of a voyage which he had undertaken from his home in Norway towards the north and east. The narrative has been preserved by its having been incorporated, along with an account of the travels of another Norseman, Wulfstan, to the southern part of the Baltic, in the first chapter of Alfred's Anglo-Saxon reproduction of the history of PAULUS

OROSIUS: *De Miseria Mundi.*[1] This work has since been the subject of translation and exposition by a great number of learned men, among whom may be named here the Scandinavians, H. G. PORTHAN of Åbo, RASMUS RASK and C. CHR. RAFN of Copenhagen.

Regarding Othere's relations to King Alfred statements differ. Some inquirers suppose that he was only on a visit at the court of the king, others that he had been sent out by King Alfred on voyages of discovery, and finally, others say that he was a prisoner of war, who incidentally narrated his experience of foreign lands. Othere's account of his travels runs as follows:—

"Othere told his lord, King Alfred, that he dwelt northmost of all the Northmen. He said that he dwelt in the land to the northward, along the West-Sea; he said, however, that that land is very long north from thence, but it is all waste, except in a few places where the Fins at times dwell, hunting in the winter, and in the summer fishing in that sea. He said that he was desirous to try, once on a time, how far that country extended due north, or whether any one lived to the north of the waste.

[1] Orosius was born in Spain in the fourth century after Christ, and died in the beginning of the fifth. He was a Christian, and wrote his work to show that the world, in opposition to the statements of several heathen writers, had been visited during the heathen period by quite as great calamities as during the Christian. This is probably the reason why his monotonous sketch of all the misfortunes and calamities which befell the heathen world was long so highly valued, was spread in many copies and printed in innumerable editions, the oldest at Vienna in 1471. In the Anglo-Saxon translation now in question, Othere's account of his journey is inserted in the first chapter, which properly forms a geographical introduction to the work written by King Alfred. This old Anglo-Saxon work is preserved in England in two beautiful manuscripts from the ninth and tenth centuries. Orosius' history itself is now forgotten, but King Alfred's introduction, and especially his account of Othere's and Wulfstan's travels, have attracted much attention from inquirers, as appears from the list of translations of this part of King Alfred's Orosius, given by Joseph Bosworth in his *King Alfred's Anglo-Saxon version of the Compendious History of the World by Orosius.* London, 1859.

He then went due north along the country, leaving all the way the waste land on the right, and the wide sea on the left. After three days he was as far north as the whale-hunters go at the farthest. Then he proceeded in his course due north, as far as he could sail within another three days; then the land there inclined due east, or the sea into the land, he knew not which; but he knew that he waited there for a west wind or a little north, and sailed thence eastward along that land as far as he could sail in four days. Then he had to wait for a due north wind because the land inclined there due south, or the sea in on that land, he knew not which. He then sailed along the coast due south, as far as he could sail in five days. There lay a great river up in that land; they then turned in that river, because they durst not sail on up the river on account of hostility; because all that country was inhabited on the other side of the river. He had not before met with any land that was inhabited since he left his own home; but all the way he had waste land on his right, except some fishermen, fowlers, and hunters, all of whom were Fins: and he had constantly a wide sea to the left. The Beormas had well cultivated their country, but they (Othere and his companions) did not dare to enter it. And the Terfinna[1] land was all waste, except where hunters, fishers, or fowlers had taken up their quarters.

"The Beormas told him many particulars both of their own land and of other lands lying around them; but he knew not what was true because he did not see it himself. It seemed to him that the Fins and the Beormas spoke nearly the same language. He went thither chiefly, in addition to seeing the country, on account of the walruses,[2] because they have very

[1] By Fins are here meant Lapps; by Terfins the inhabitants of the Tersk coast of Russian Lapland.

[2] Walruses are still captured yearly on the ice at the mouth of the White Sea, not very far from the shore (cf. A. E. Nordenskiöld, *Redogörelse för en expedition till mynningen af Jenisej och Sibirien år* 1875, p. 23; *Bihang till Vetenskaps-Akad. Handl.* B. iv. No. 1). Now they occur there indeed only in small numbers, and, it appears, not in the immediate neighbourhood of land; but there is scarcely any doubt that in former days they were common on the most northerly coasts of Norway. They have evidently been driven away thence in the same way as they are now being driven away from Spitzbergen. With what rapidity their numbers at the latter place are yearly diminished, may be seen from the fact that during my many Arctic journeys, beginning in 1858, I never saw walruses on Bear Island or the west coast of Spitzbergen, but have conversed with hunters

noble bones in their teeth, of which the travellers brought some to the king; and their hides are very good for ship-ropes. These whales are much less than other whales, not being longer than seven ells. But in his own country is the best whale-hunting. There they are eight-and-forty ells long, and the largest are fifty ells long. Of these he said he and five others had killed sixty in two days.[1] He was a very wealthy man in those possessions in which their wealth consists, that is, in wild deer. He had at the time he came to the king, six hundred unsold tame deer. These deer they call rein-deer, of which there were six decoy rein-deer, which are very valuable among the Fins, because they catch the wild rein-deer with them.

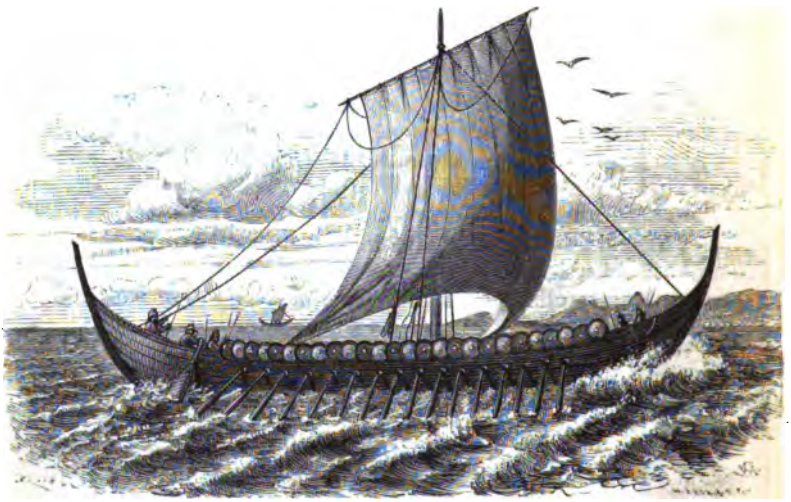
"He was one of the first men in that country, yet he had not more than twenty horned cattle, twenty sheep and twenty swine, and the little that he ploughed he ploughed with horses. But their wealth consists mostly in the rent paid them by the Fins. That rent is in skins of animals and birds' feathers, and whalebone, and in ship-ropes made of whales'[2] hides, and of seals'. Every one pays according to his birth; the best-born, it is said, pay the skins of fifteen martens, and five rein-deers, and one bear's skin, ten ambers of feathers, a bear's or otter's skin kyrtle, and two ship-ropes, each sixty ells long, made either of whale or of seal hide."

who ten years before had seen them in herds of hundreds and thousands. I have myself seen such herds in Hinloopen Strait in July 1861, but when during my journeys in 1868 and 1872-3 I again visited the same regions, I saw there not a single walrus.

[1] As it appears to be impossible for six men to kill sixty great whales in two days, this passage has caused the editors of Othere's narrative much perplexity, which is not wonderful if great whales, as the *Balæna mysticetus*, are here meant. But if the narrative relates to the smaller species of the whale, a similar catch may still, at the present day, be made on the coasts of the Polar countries. For various small species go together in great shoals; and, as they occasionally come into water so shallow that they are left aground at ebb, they can be killed with ease. Sometimes, too, a successful attempt is made to drive them into shallow water. That whales visit the coast of Norway in spring in large shoals dangerous to the navigator is also stated by Jacob Ziegler, in his work, *Quæ intus continentur Syria, Palestina, Arabia, Ægyptus, Schondia, &c.* Argentorati, 1532, p. 97.

[2] In this case is meant by "whale" evidently the walrus, whose skin is still used for lines by the Norwegian walrus-hunters, by the Eskimo, and the Chukchis. The skin of the true whale might probably be used for the same purpose, although, on account of its thickness, perhaps scarcely with advantage without the use of special tools for cutting it up.

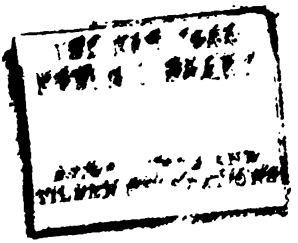
The continuation of Othere's narrative consists of a sketch of the Scandinavian peninsula, and of a journey which he undertook from his home towards the south. King Alfred then gives an account of the Dane, Wulfstan's voyage in the Baltic. This part of the introduction to Orosius, however, has too remote a connection with my subject to be quoted in this historical sketch.

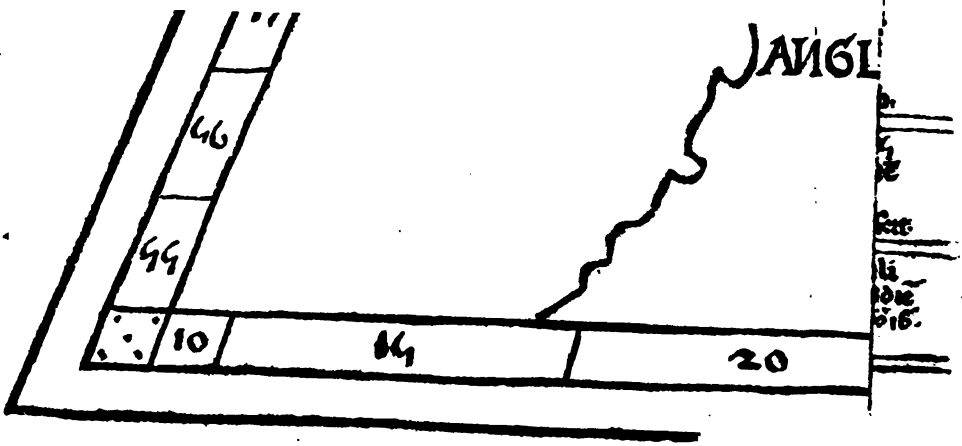


NORSE SHIP OF THE TENTH CENTURY.

Drawn with reference to the vessel found at Sandefjord in 1880, under the superintendence of Ingvald Undset, Assistant at the Christiania University's collection of Northern antiquities.

It appears from Othere's simple and very clear narrative that he undertook a veritable voyage of discovery in order to explore the unknown lands and sea lying to the north-east. This voyage was also very rich in results, as in the course of it the northernmost part of Europe was circumnavigated. Nor perhaps is there any doubt that during this voyage Othere penetrated as far as to the mouth of the Dwina or at least

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of the Mesen in the land of the Beormas.[1] We learn from the narrative besides, that the northernmost part of Scandinavia was already, though sparsely, peopled by Lapps, whose mode of life did not differ much from that followed by their descendants, who live on the coast at the present day.

The Scandinavian race first migrated to Finmark and settled there in the 13th century, and from that period there was naturally spread abroad in the northern countries a greater knowledge of those regions, which, however, was for a long time exceedingly incomplete, and even in certain respects less correct than Othere's. The idea of the northernmost parts of Europe, which was current during the first half of the 16th century, is shown by lithographed copies of two maps of the north, one dated 1482, the other 1532,[2] which are appended to this work. On the latter of these Greenland is still delineated as connected with Norway in the neighbourhood of Vardoehus. This map, however, is grounded, according to the statement of the author in the introduction, among other sources, on the statements of two archbishops of the diocese of Nidaro,[3] to which Greenland and Finmark belonged, and from whose inhabited parts

[1] It ought to be remarked here that the distances which Othere in that case traversed every day, give a speed of sailing approximating to that which a common sailing vessel of the present day attains *on an average*. This circumstance, which on a cursory examination may appear somewhat strange, finds its explanation when we consider that Othere sailed only with a favourable wind, and, when the wind was unfavourable, lay still. It appears that he usually sailed 70′ to 80′ in twenty-four hours, or perhaps rather *per diem*.

[2] The maps are taken from *Ptolemæi Cosmographia latine reddita a Jac. Angelo, curam mapparum gerente Nicolao Donis Germano, Ulmæ* 1482, and from the above-quoted work of Jacobus Ziegler, printed in 1532. That portion of the latter which concerns the geography of Scandinavia is reprinted in *Geografiska Sektionens Tidskrift*, B. I. Stockholm, 1878.

[3] These were the Dane, Erik Valkendorff, and the Norwegian, Olof Engelbrektsson. The Swedes, Johannes Magnus, Archbishop of Upsala, and Peder Maonsson, Bishop of Vesteraos, also gave Ziegler important information regarding the northern countries.

expeditions were often undertaken both for trade and plund
by land and sea, as far away as to the land of the Beormas.
is difficult to understand how with such maps of the distributi
of land in the north the thought of the north-east passage cou
arise, if voices were not even then raised for an altogeth
opposite view, grounded partly on a survival of the old ide
we may say the old popular belief, that Asia, Europe a
Africa were surrounded by water, partly on stories of India
having been driven by wind to Europe, along the north coast
Asia.[1] To these was added in 1539 the map of the north by th

[1] Of these much-discussed narratives concerning *Indians*—probabl
men from North Scandinavia, Russia, or North America, certainly n
Japanese, Chinese, or Indians—who were driven by storms to the coast
of Germany, the first comes down to us from the time before the birth o
Christ. For B.C. 62 Quintus Metellus Celer, "when as proconsul h
governed Gaul, received as a present from the King of the Bæti [Pliny
says of the Suevi] some Indians, and when he inquired how they came
to those countries, he was informed that they had been driven by storm
from the Indian Ocean to the coasts of Germany" (Pomponius Mela, lib. iii.
cap. 5, after a lost work of Cornelius Nepos. Plinius, *Hist. Nat.*, lib. ii.
cap. 67).

Of a similar occurrence in the middle ages, the learned Æneas Sylvius,
afterwards Pope under the name of Pius II., gives the following account
of his cosmography:—"I have myself read in Otto [Bishop Otto, of
Freising], that in the time of the German Emperor an Indian vessel and
Indian merchants were driven by storm to the German coast. Certain it
was that, driven about by contrary winds, they came from the east, which
had been by no means possible, if, as many suppose, the North Sea were
unnavigable and frozen" (Pius II., *Cosmographia in Asiæ et Europæ eleganti
descriptione, etc.*, Parisiis, 1509, leaf 2). Probably it is the same occurrence
which is mentioned by the Spanish historian Gomara (*Historia general de
las Indias*, Saragoça, 1552-53), with the addition, that the Indians stranded
at Lübeck in the time of the Emperor Frederick Barbarossa (1152-1190).
Gomara also states that he met with the exiled Swedish Bishop Olaus
Magnus, who positively assured him that it was possible to sail from
Norway by the north along the coasts to China (French translation of the
above-quoted work, Paris, 1587, leaf 12). An exceedingly instructive
treatise on this subject is to be found in *Aarböger for nordisk Oldkyn-
dighed og Historie*, Kjöbenhavn, 1880. It is written by F. Schiern, and
entitled *Om en etnologisk Gaade fra Oldtiden.*

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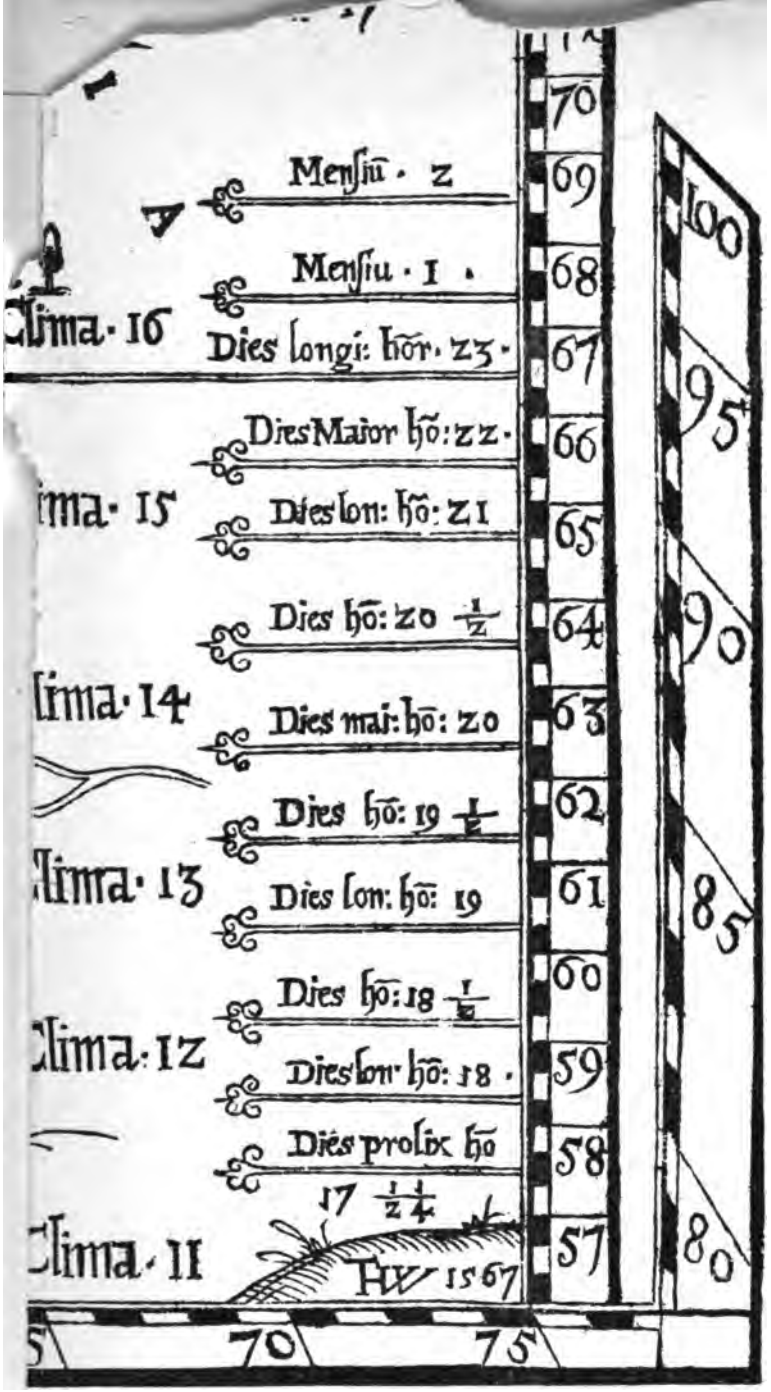
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Swedish bishop OLAUS MAGNUS,[1] which for the first time gave to Scandinavia an approximately correct boundary towards the north. Six hundred years,[2] in any case, had run their course before Othere found a successor in Sir Hugh Willoughby ; and it is usual to pass by the former, and to ascribe to the latter the honour of being the first in that long succession of men who endeavoured to force a passage by the north-east from the Atlantic Ocean to China.

Here however it ought to be remarked that while such maps as those of Ziegler were published in western Europe, other and better knowledge of the regions in question prevailed in the north. For it may be considered certain that Norwegians, Russians and Karelians often travelled in boats on peaceful or warlike errands, during the fifteenth and beginning of the sixteenth century, from the west coast of Norway to the White Sea, and in the opposite direction, although we find nothing on record regarding such journeys except the account that SIGISMUND VON

[1] Olaus Magnus, *Auslegung und Verklerung der neuen Mappen von den alten Gœttenreich*, Venedig, 1539. Now perhaps (according to a communication from the Librarian-in-chief, G. E. Klemming) there is scarcely any copy of this edition of the map still in existence, but it is given unaltered in the 1567 Basel edition of Olaus Magnus, "*De gentium septentrionalium variis conditionibus*," &c. The edition of the same work printed at Rome in 1555, on the other hand, has a map, which differs a little from the original map of 1539.

[2] To interpret Nicolò and Antonio Zeno's travels towards the end of the fourteenth century, which have given rise to so much discussion, as Mr. Fr. Krarup has done, in such a way as if they had visited the shores of the Arctic Ocean and the White Sea, appears to me to be a very unfortunate guess, opposed to innumerable particulars in the narrative of the Zenos, and to the accompanying map, remarkable in more respects than one, which was first published at Venice in 1558, unfortunately in a somewhat "improved" form by one of Zeno's descendants. On the map there is the date MCCCLXXX. (Cf. *Zeniernes Reise til Norden, et Tolknings Forsög*, af Fr. Krarup, Kjöbenhavn, 1878 ; R. H. Major, *The Voyages of the Venetian Brothers Nicolò and Antonio Zeno*, London, 1873, and other works concerning these much-bewritten travels).

HERBERSTEIN[1] gives, in his famous book on Russia, of the voyage of GREGORY ISTOMA and the envoy DAVID from the White Sea to Trondhjem in the year 1496.

The voyage is inserted under the distinctive title *Navigatio per Mare Glaciale*,[2] and the narrative begins with an explanation that Herbertstein got it from Istoma himself, who, when a youth, had learned Latin in Denmark. As the reasons for choosing the unusual, long, "but safe" circuitous route over the North Sea in preference to the shorter way that was usually taken, Istoma gives the disputes between Sweden and Russia, and the revolt of Sweden against Denmark, at the time when the voyage was undertaken (1496). After giving an account of his journey from Moscow to the mouth of the Dwina, he continues thus:—

"After having gone on board of four boats, they kept first along the right bank of the ocean, where they saw very high mountain peaks;[3] and after having in this way travelled six-

[1] The first edition, entitled *Rerum Moscoviticarum Commentarii, &c.*, Vienna, 1549, has three plates, and a map of great value for the former geography of Russia. It is, however, to judge by the copy in the Royal Library at Stockholm, partly drawn by hand, and much inferior to the map in the Italian edition of the following year (*Comentari della Moscovia et parimente della Russia, &c., per il Signor Sigismondo libero Barone in Herbetstain, Neiperg and Guetnbag, tradotti nuaomente di Latino in lingua nostra volgare Italiana*, Venetia, 1550, with two plates and a map, with the inscription "per Giacomo Gastaldo cosmographo in Venetia, MDL"). Von Herbertstein visited Russia as ambassador from the Roman Emperor on two occasions, the first time in 1517, the second in 1525, and on the ground of these two journeys published a sketch of the country, by which it first became known to West-Europeans, and even for Russians themselves it forms an important original source of information regarding the state of civilisation of the empire of the Czar in former times. Von Adelung enumerates in *Kritisch-literärische Übersicht der Reisenden in Russland bis 1700*, St. Petersburg and Leipzig, 1846, eleven Latin, two Italian, nine German, and one Bohemian translation of this work. An English translation has since been published by the Hakluyt Society.

[2] *Von Herbertstein*, first edition, leaf xxviii., in the second of the three separately-paged portions of the work.

[3] An erroneous transposition of mountains seen in Norway, the north-eastern shore of the White Sea being low land.

teen miles, and crossed an arm of the sea, they followed the western strand, leaving on their right the open sea, which like the neighbouring mountains has its name from the river Petzora. They came here to a people called Fin-Lapps, who, though they dwell in low wretched huts by the sea, and live almost like wild beasts, in any case are said to be much more peaceable than the people who are called wild Lapps. Then, after they had passed the land of the Lapps and sailed forward eighty miles, they came to the land, Nortpoden, which is part of the dominions of the King of Sweden. This region the Rutheni call Kayenska Selma, and the people they call Kayeni. After sailing thence along a very indented coast which jutted out to the right, they came to a peninsula, called the Holy Nose,[1] consisting of a great rock, which like a nose projects into the sea. But in this there is a grotto or hollow which for six hours at a time swallows up water, and then with great noise and din casts out again in whirls the water which it had swallowed. Some call it the navel of the sea, others Charybdis. It is said that this whirlpool has such power, that it draws to itself ships and other things in its neighbourhood and swallows them. Istoma said that he had never been in such danger as at that place, because the whirlpool drew the ship in which he travelled with such force, that it was only by extreme exertion at the oars that they could escape. After passing this *Holy Nose* they came to a rocky promontory, which they had to sail round. After having waited here some days on account of head winds, the skipper said: 'This rock, which ye see, is called Semes, and we shall not get so easily past it if it be not propitiated by some offering.' Istoma said that he reproved the skipper for his foolish superstition, on which the reprimanded skipper said nothing more. They waited thus the fourth day at the place on account of the stormy state of the sea, but after that the storm ceased, and the anchor was weighed. When the voyage was now continued with a favourable wind, the skipper said: 'You laughed at my advice to propitiate the Semes rock, and considered it a foolish superstition, but it certainly would have been impossible for us to get past it, if I had not secretly by night ascended the rock and sacrificed.' To the inquiry what he had offered, the skipper replied: 'I scattered oatmeal mixed with butter on the projecting rock which we saw.' As they sailed further they came to another great promontory,

[1] An unfortunate translation, which often occurs in old works, of Swjatoinos, "the holy headland."

called Motka, resembling a peninsula. At the end of this there was a castle, Barthus, which means *vakthus*, watch-house, for there the King of Norway keeps a guard to protect his frontiers. The interpreter said that this promontory was so long that it could scarcely be sailed round in eight days, on which account, in order not to be delayed in this way, they carried their boats and baggage with great labour on their shoulders over land for the distance of about half a mile. They then sailed on along the land of the Dikilopps or wild Lapps to a place which is called Dront (Trondhjem) and lies 200 miles north of[1] the Dwina. And they said that the prince of Moscow used to receive tribute as far as to this place."

The narrative is of interest, because it gives us an idea of the way in which men travelled along the north coast of Norway, four hundred years ago. It may possibly have had an indirect influence on the sending of Sir Hugh Willoughby's expedition, as the edition of Herbertstein's work printed at Venice in 1550 probably soon became known to the Venetian, Cabot, who, at that time, as Grand Pilot of England, superintended with great care the fitting out of the first English expedition to the north-east.

There is still greater probability that the map of Scandinavia by Olaus Magnus, already mentioned, was known in England before 1553. This map is an expression of a view which before that time had taken root in the north, which, in opposition to the maps of the South-European cosmographers, assumed the existence of an open sea-communication in the north, between the Chinese Sea and the Atlantic, and which even induced GUSTAF VASA to attempt to bring about a north-east expedition. This unfortunately did not come to completion, and all that we know of it is contained in a letter to the Elector August of Saxony, from the Frenchman HUBERT LANGUET, who visited Sweden in 1554. In this letter, dated 1st April 1576, Languet

[1] Instead of "north of," the true reading probably is "beyond" the Dwina.

says:—"When I was in Sweden twenty-two years ago, King Gustaf often talked with me about this sea route. At last he urged me to undertake a voyage in this direction, and promised to fit out two vessels with all that was necessary for a protracted voyage, and to man them with the most skilful seamen, who should do what I ordered. But I replied that I preferred journeys in inhabitated regions to the search for new unsettled lands."[1] If Gustaf Vasa had found a man fit to carry out his great plans, it might readily have happened that Sweden would have contended with England for the honour of opening the long series of expeditions to the north-east.[2]

England's navigation is at present greater beyond comparison than that of any other country, but it is not of old date. In the middle of the sixteenth century it was still very inconsiderable, and mainly confined to coast voyages in Europe, and a few fishing expeditions to Iceland and Newfoundland.[3] The great

[1] Huberti Langueti *Epistolæ Secretæ*, Halæ, 1699, i. 171. Compare also a paper by A. G. Ahlquist, in *Ny Illustrerad Tidning* for 1875, p. 270.

[2] The first to incite to voyages of discovery in the polar regions was an Englishman, Robert Thorne, who long lived at Seville. Seeing all other countries were already discovered by Spaniards and Portuguese, he urged Henry VIII. in 1527 to undertake discoveries in the north. After reaching the Pole (going sufficiently far north) one could turn to the east, and, first passing the land of the Tartars, get to China and so to Malacca, the East Indies, and the Cape of Good Hope, and thus circumnavigate the "whole world." One could also turn to the west, sail along the back of Newfoundland, and return by the Straits of Magellan (Richard Hakluyt, *The Principael Navigations, Voiages, and Discoveries of the English Nation, &c.*, London, 1589, p. 250). Two years before, Paulus Jovius, on the ground of communications from an ambassador from the Russian Czar to Pope Clement VII., states that Russia is surrounded on the north by an immense ocean, by which it is possible, if one keeps to the right shore, and if no land comes between, to sail to China. (Pauli Jovii *Opera Omnia*, Basel, 1578, third part, p. 88; the description of Russia, inserted there under the title "Libellus de legatione Basilii ad Clementem VII.," was printed for the first time at Rome in 1525.)

[3] In the year 1540, London, exclusive of the Royal Navy, had no more than four vessels, whose draught exceeded 120 tons (Anderson, *Origin of Commerce*, London, 1787, vol. ii. p. 67). Most of the coast towns of

power of Spain and Portugal by sea, and their jealousy of other countries rendered it impossible at that period for foreign seafarers to carry on traffic in the East-Asiatic countries, which had been sketched by Marco Polo with so attractive accounts of unheard-of richness in gold and jewels, in costly stuffs, in spices and perfumes. In order that the merchants of northern Europe might obtain a share of the profit, it appeared to be necessary to discover new routes, inaccessible to the armadas of the Pyrenean peninsula. Here lies the explanation of the zeal with which the English and the Dutch, time after time, sent out vessels, equipped at great expense, in search of a new way to India and China, either by the Pole, by the north-west, along the north coast of the new world, or by the north-east, along the north coast of the old. The voyages first ceased when the maritime supremacy of Spain and Portugal was broken. By none of them was the intended object gained, but it is remarkable that in any case they gave the first start to the development of England's ocean navigation.

Sir HUGH WILLOUGHBY'S in 1553 was thus the first maritime expedition undertaken on a large scale, which was sent from England to far distant seas. The equipment of the vessels was carried out with great care under the superintendence of the famous navigator, Sebastian Cabot, then an old man, who also gave the commander precise instructions how he should behave in the different incidents of the voyage. Some of these instructions now indeed appear rather childish,[1] but others might still be used as rules for every well-ordered exploratory expedition. Sir Hugh besides obtained from Edward VI. an

Scandinavia have thus in our days a greater sea-going fleet than London had at that time.

[1] For instance Article 30: "Item, if you shall see them [the foreigners met with during the voyage] weare Lyons or Bears skinnes, hauing long bowes, and arrowes, be not afraid of that sight: for such be worne oftentimes more to feare strangers, then for any other cause." (*Hakluyt*, 1st edition, p. 262.)

SIR HUGH WILLOUGHBY.

(After a portrait in the Great Picture Hall, Greenwich.)

open letter written in Latin, Greek, and several other languages, in which it was stated that discoveries and the making of commercial treaties were the sole objects of the expedition; and the people, with whom the expedition might come in contact, were requested to treat Sir Hugh Willoughby as they themselves would wish to be treated in case they should come to England. So sanguine were the promoters of the voyage of its success in reaching the Indian seas by this route, that they caused the

SEBASTIAN CABOT.

After a portrait in E. Vale Blake's Arctic Experiences, London, 1874.[1]

ships that were placed at Sir Hugh Willoughby's disposal to be sheathed with lead in order to protect them from the attacks of the teredo and other worms.[2] These vessels were :—

[1] The endeavour to procure for this work a copy of an original portrait of Cabot, stated to be in existence in England, has unfortunately not been crowned with success.

[2] According to Clement Adams' account of the voyage. (*Hakluyt*, 1st edition, p. 271.)

1. The *Bona Esperanza*, admiral of the fleet, of 120 tons burden, on board of which was Sir Hugh Willoughby, himself, as captain general of the fleet. The number of persons in this ship, including Willoughby, the master of the vessel, William Gefferson, and six merchants, was thirty-five.

2. The *Edward Bonaventure*, of 160 tons burden, the command of which was given to Richard Chancelor, captain and pilot major of the fleet. There were on board this vessel fifty men, including two merchants. Among the crew whose names are given in Hakluyt we find the name of Stephen Burrough, afterwards renowned in the history of the north-east passage, and that of Arthur Pet.

3. The *Bona Confidentia*, of ninety tons, under command of Cornelius Durfoorth, with twenty-eight men, including three merchants.

The expense of fitting out the vessels amounted to a sum of £6,000, divided into shares of £25. Sir Hugh Willoughby was chosen commander "both by reason of his goodly personage (for he was of tall stature) as also for his singular skill in the services of warre."[1] In order to ascertain the nature of the lands of the east, two "Tartars" who were employed at the royal stables were consulted, but without any information being obtained from them. The ships left Ratcliffe the $\frac{20}{10}$th May 1553.[2] They were towed down by the boats, "the mariners being apparelled in watchet or skie coloured cloth," with a favourable wind to Greenwich, where the court then was. The King being unwell could not be present, but "the courtiers came running out, and the common people flockt together,

[1] "Cum ob corporis formam (erat enim proceræ staturæ) tum ob singularem in re bellica industriam." Clement Adams' account.—*Hakluyt*, p. 271.

[2] Ten days earlier or later are of very great importance with respect to the state of the ice in summer in the Polar seas. I have, therefore, in quoting from the travels of my predecessors, reduced the old style to the new.

standing very thicke upon the shoare; the Privie Consel, they lookt out at the windowes of the court, and the rest ran up to the toppes of the towers; the shippes hereupon discharge their ordinance, and shoot off their pieces after the maner of warre, and of the sea, insomuch that the tops of the hilles sounded therewith, the valleys and the waters gave an echo, and the mariners they shouted in such sort, that the skie rang again with the noise thereof."[1] All was joy and triumph; it seemed as if men foresaw that the greatest maritime power, the history of the world can show, was that day born.

The voyage itself was, however, very disastrous for Sir Hugh and many of his companions. After sailing along the east coast of England and Scotland the three vessels crossed in company to Norway, the coast of which came in sight the $\frac{2}{14}$th July in 66° N. L. A landing was effected and thirty small houses were found, whose inhabitants had fled, probably from fear of the foreigners. The region was called, as was afterwards ascertained, "Halgeland," and was just that part of Norway from which Othere began his voyage to the White Sea. Hence they sailed on along the coast. On the $\frac{6\text{th Aug.}}{27\text{th July}}$ they anchored in a harbour, "Stanfew" (perhaps Steenfjord on the west coast of Lofoten), where they found a numerous and friendly population, with no articles of commerce, however, but dried fish and train oil. In the middle of September the *Edward Bonaventure*, at Senjen during a storm, parted company with the two other vessels. These now endeavoured to reach Vardoehus, and therefore sailed backwards and forwards in different directions, during which they came among others to an uninhabited, ice-encompassed land, along whose coast the sea was so shallow that it was impossible for a boat to land. It was said to be situated 480′ east by north

[1] "Vibrantur bombardarum fulmina, Tartariæ volvuntur nubes, Martem sonant crepitacula, reboant summa montium juga, reboant valles, reboant undæ, claraque Nautarum percellit sydera clamor." Clement Adams' account.—*Hakluyt*, p. 272.

from Senjen, in 72° N. L.[1] Hence they sailed first to the north, then to the south-east. Thus they reached the coast of Russian Lapland, where, on the $\frac{2}{1}\frac{3}{8}$th September they found a good harbour, in which Sir Hugh determined to pass the winter. The harbour was situated at the mouth of the river Arzina "near Kegor." Of the further fate of Sir Hugh Willoughby and his sixty-two companions, we know only that during the course of the winter they all perished, doubtless of scurvy. The journal of the commander ends with the statement that immediately after the arrival of the vessels three men were sent south-south west, three west, and three south-east to search if they could find people, but that they all returned "without finding of people or any similitude of habitation." The following year Russian fishermen found at the wintering station the ships and dead bodies of those who had thus perished, together with the journal from which the extract given above is taken, and a will witnessed by Willoughby,[2] from which it appeared that he himself and most of the company of the two ships were alive in January, 1554.[3] The two vessels, together with Willoughby's

[1] At the time when the whale-fishing at Spitzbergen commenced, Thomas Edge, a captain of one of the Muscovy Company's vessels, endeavoured to show that the land which Willoughby discovered while sailing about after parting company with Chancelor was Spitzbergen (*Purchas*, iii. p. 462). The statement, which was evidently called forth by the wish to monopolise the Spitzbergen whale-fishing for England, can be shown to be incorrect. It has also for a long time back been looked upon as groundless. Later inquirers have instead supposed that the land which Willoughby saw was Gooseland, on Novaya Zemlya. For reasons which want of space prevents me from stating here, this also does not appear to me to be possible. On the other hand, I consider it highly probable that "Willoughby's Land" was Kolgujev Island, which is surrounded by shallow sand-banks. Its latitude has indeed in that case been stated 2° too high, but such errors are not impossible in the determinations of the oldest explorers.

[2] The testator was Gabriel Willoughby, who, as merchant, sailed in the commander's vessel.

[3] *Hakluyt*, p. 500; *Purchas*, iii. p. 249, and in the margin of p. 463.

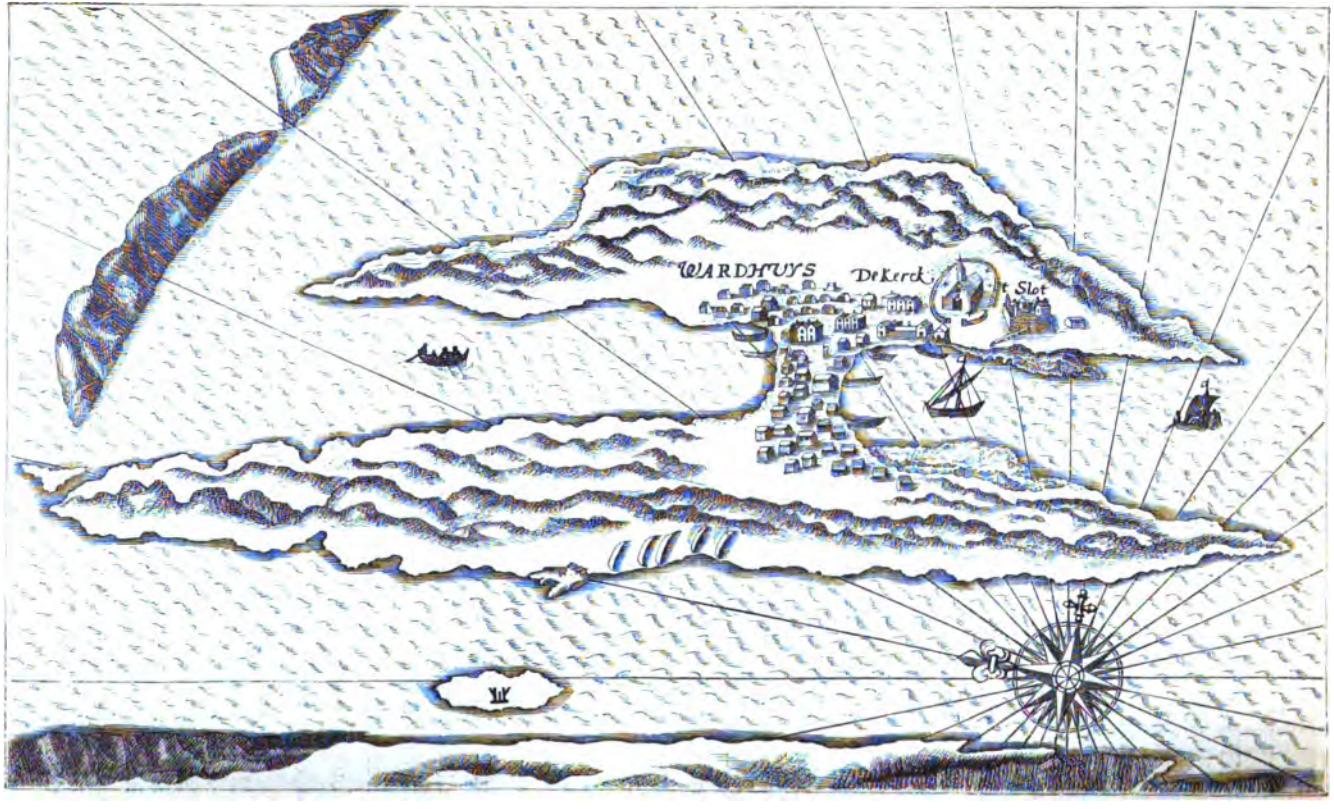
corpse, were sent to England in 1555 by the merchant George Killingworth.[1]

With regard to the position of Arzina it appears from a statement in Anthony Jenkinson's first voyage (*Hakluyt*, p. 335) that it took seven days to go from Vardoehus to Swjatoinos, and that on the sixth he passed the mouth of the river where Sir Hugh Willoughby wintered. At a distance from Vardoehus of about six-sevenths of the way between that town and Swjatoinos, there debouches into the Arctic Ocean, in 68° 20 N. L. and 38° 30′ E. L. from Greenwich, a river, which in recent maps is called the Varzina. It was doubtless at the mouth of this river that two vessels of the first North-east Passage Expedition wintered with so unfortunate an issue for the officers and men.

The third vessel, the *Edward Bonaventure*, commanded by Chancelor, had on the contrary a successful voyage, and one of great importance for the commerce of the world. As has been already stated, Chancelor was separated from his companions during a storm in August. He now sailed alone to Vardoehus. After waiting there seven days for Sir Hugh Willoughby, he set out again, resolutely determined "either to bring that to passe which was intended, or else to die the death;" and though "certaine Scottishmen" earnestly attempted to persuade him to return, "he held on his course towards that unknown part of the world, and sailed so farre that hee came at last to the place where hee found no night at all, but a continuall light and brightnesse of the sunne shining clearly upon the huge and mighty sea."[2] In this way he

[1] It is of him that it is narrated in a letter written from Moscow by Henrie Lane, that the Czar at an entertainment "called them to his table, to receave each one a cuppe from his hand to drinke, and tooke into his hand Master George Killingworths beard, which reached over the table, and pleasantly delivered it the Metropolitane, who seeming to bless it, sad in Russe, 'this is Gods gift.' "—*Hakluyt*, p. 500.

[2] As the Dwina lies to the south of Vardoehus, these remarks probably relate to an earlier part of the voyage than that which is referred to in the narrative.



VARDOE IN 1594.
After Linschoten

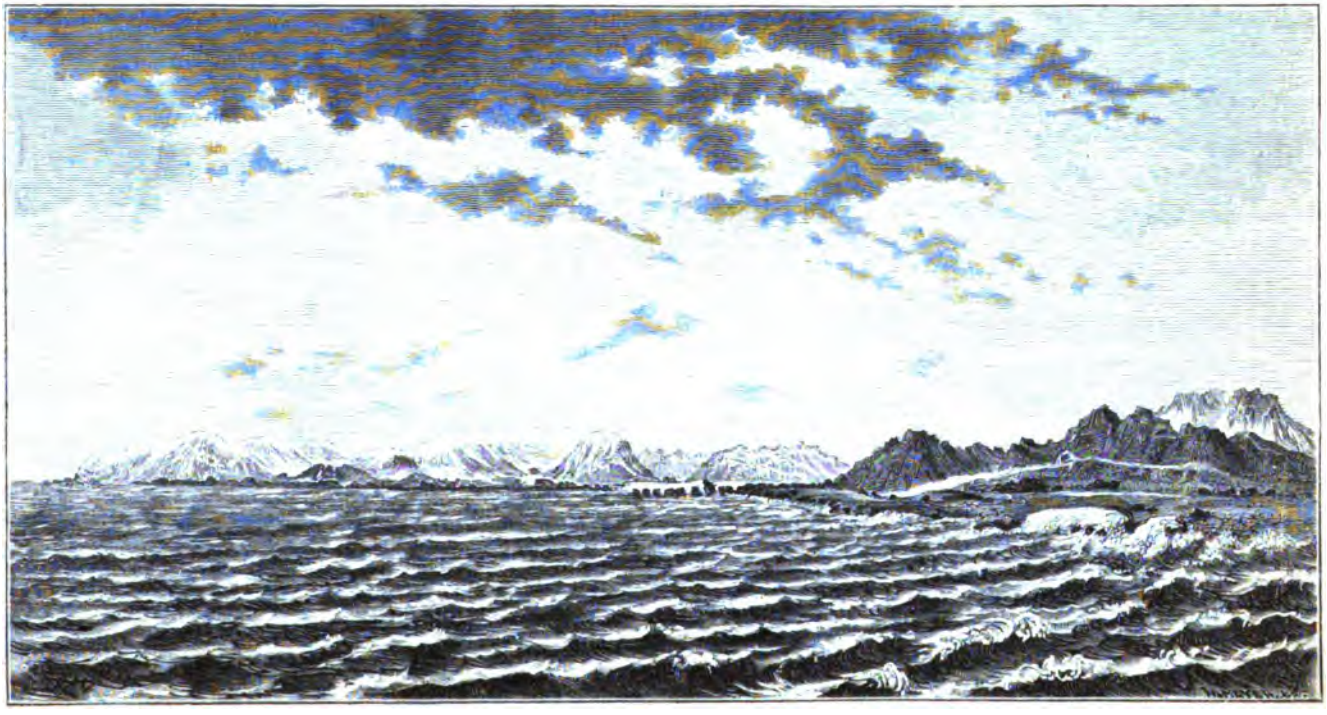
VARDOE IN OUR DAYS.
After a photograph.

finally reached the mouth of the river Dwina in the White Sea, where a small monastery was then standing at the place where Archangel is now situated. By friendly treatment he soon won the confidence of the inhabitants, who received him with great hospitality. They, however, immediately sent off a courier to inform Czar Ivan Vasilievitsch of the remarkable occurrence. The result was that Chancelor was invited to the court at Moscow, where he and his companions passed a part of the winter, well entertained by the Czar. The following summer he returned with his vessel to England. Thus a commercial connection was brought about, which soon became of immense importance to both nations, and within a few years gave rise to a number of voyages, of which I cannot here give any account, as they have no connection with the history of the North-east Passage.[1]

Great geographer or seaman Sir Hugh Willoughby clearly was not, but his and his followers' voluntary self-sacrifice and undaunted courage have a strong claim on our admiration. Incalculable also was the influence which the voyages of Willoughby and Chancelor had upon English commerce, and on the development of the whole of Russia, and of the north of Norway. From the monastery at the mouth of the Dwina a flourishing commercial town has arisen, and a numerous population has settled on the coast of the Polar Sea, formerly so desolate. Already there is regular steam and telegraphic communication to the

[1] Writings on these voyages are exceedingly numerous. An account of them was published for the first time in Hakluyt, *The principael Navigations, Voiages, and Discoveries of the English Nation, &c.*, London, 1589; *Ordinances, King Edward's Pass, &c.*, p. 259; *Copy of Sir Hugh Willoughby's Journal, with a List of all the Members of the Expedition*, p. 265; *Clement Adams' Account of Chancelor's Voyage*, p. 270, &c. The same documents were afterwards printed in Purchas' *Pilgrimage*, iii. p. 211. For those who wish to study the literature of this subject further, I may refer to Fr. von Adelung, *Kritisch-literärische Übersicht der Reisenden in Russland*, St. Petersburg and Leipzig, 1846, p. 200; and I. Hamel, *Tradescant der Aeltere 1618 in Russland*, St. Petersburg and Leipzig, 1847.

confines of Russia. The people of Vardoe can thus in a few hours get accounts of what has happened not only in Paris or London, but also in New York, the Indies, the Cape, Australia, Brazil, &c., while a hundred years ago the post came thither only once a year. It was then that a journal-loving commandant took the step, giving evidence of strong self-command, of not "devouring" the post at once, but reading the newspapers day by day a year after they were published. All this is now different, and yet men are not satisfied. The interests of commerce and the fisheries require railway communication with the rest of Europe. That will certainly come in a few years, nor will it be long before the telegraph has spun its net, and regular steam communication has commenced along the coast of the Arctic Ocean far beyond the sea which was opened by Chancelor to the commerce of the world.



COAST LANDSCAPE FROM MATOTSCHKIN SCHAR.
After Svenske.

CHAPTER II.

Departure from Maosoe—Gooseland—State of the Ice—The Vessels of the Expedition assemble at Chabarova—The Samoyed town there—The Church—Russians and Samoyeds—Visit to Chabarova in 1875—Purchase of Samoyed Idols—Dress and Dwellings of the Samoyeds—Comparison of the Polar Races—Sacrificial Places and Samoyed Grave on Vaygats Island visited—Former accounts of the Samoyeds—Their place in Ethnography.

THE *Vega* was detained at Maosoe by a steady head wind, rain, fog, and a very heavy sea till the evening of the 25th July. Though the weather was still very unfavourable, we then weighed anchor, impatient to proceed on our voyage, and steamed out to sea through Mageroe Sound. The *Lena* also started at the same time, having received orders to accompany the *Vega* as far as possible, and, in case separation could not be avoided, to steer her course to the point, Chabarova in Yugor Schar, which I had fixed on as the rendezvous of the four vessels of the expedition. The first night, during the fog that then prevailed, we lost sight of the *Lena*, and did not see her again until we had reached the meeting place.

The course of the *Vega* was shaped for South Goose Cape. Although, while at Tromsoe, I had resolved to enter the Kara Sea through Yugor Schar, the most southerly of the sounds which lead to it—so northerly a course was taken, because experience has shown that in the beginning of summer so much ice often drives backwards and forwards in the bay between the west coast of Vaygats Island and the mainland,

that navigation in these waters is rendered rather difficult. This is avoided by touching Novaya Zemlya first at Gooseland, and thence following the western shore of this island and Vaygats to Yugor Schar. Now this precaution was unnecessary; for the state of the ice was singularly favourable, and Yugor Schar was reached without seeing a trace of it.

During our passage from Norway to Gooseland we were favoured at first with a fresh breeze, which, however, fell as we approached Novaya Zemyla; this notwithstanding, we made rapid progress under steam, and without incident, except that the excessive rolling of the vessel caused the overturn of some boxes containing instruments and books, fortunately without any serious damage ensuing.

Land was sighted on the 28th July at 10.30 P.M. It was the headland which juts out from the south of Gooseland in 70° 33′ N. L. and 51° 54′ E. L. (Greenwich). Gooseland is a low stretch of coast, occupied by grassy flats and innumerable small lakes, which projects from the mainland of Novaya Zemlya between 72° 10′ and 71° 30′ N. L. The name is a translation of the Russian Gusinnaja Semlja, and arises from the large number of geese and swans (*Cygnus Bewickii*, YARR.) which breed in that region. The geese commonly place their exceedingly inconsiderable nests on little hillocks near the small lakes which are scattered over the whole of Gooseland; the powerful swans, which are very difficult of approach by the hunter, on the other hand breed on the open plain. The swans' nests are so large that they may be seen at a great distance. The building material is moss, which is plucked from the ground within a distance of two metres from the nest, which by the excavation which is thus produced, is surrounded by a sort of moat. The nest itself forms a truncated cone, 0·6 metre high and 2·4 metres in diameter at the bottom. In its upper part there is a cavity, 0·2 metre deep and 0·6 metre broad, in which the four large grayish-white eggs of the bird are laid.

The female hatches the eggs, but the male also remains in the neighbourhood of the nest. Along with the swans and geese, a large number of waders, a couple of species of Lestris, an owl and other birds breed on the plains of Gooseland, and a few guillemots or gulls upon the summits of the strand cliffs. The avifauna along the coast here is besides rather poor. At least there are none of the rich fowl-fells, which, with their millions of inhabitants and the conflicts and quarrels which rage amongst them, commonly give so peculiar a character to the coast cliffs of the high north. I first met with true loom and kittiwake fells farther north on the southern shore of Besimmanaja Bay.

Although Gooseland, seen from a distance, appears quite level and low, it yet rises gradually, with an undulating surface, from the coast towards the interior, to a grassy plain about sixty metres above the sea-level, with innumerable small lakes scattered over it. The plain sinks towards the sea nearly everywhere with a steep escarpment, three to fifteen metres high, below which there is formed during the course of the winter an immense snowdrift or so-called "snow-foot," which does not melt until late in the season. *There are no true glaciers here, nor any erratic blocks, to show that circumstances were different in former times.* Nor are any snow-covered mountain-tops visible from the sea. It is therefore possible at a certain season of the year (during the whole of the month of August) to sail from Norway to Novaya Zemlya, make sporting excursions there, and return without having seen a trace of ice or snow. This holds good indeed only of the low-lying part of the south island, but in any case it shows how erroneous the prevailing idea of the natural state of Novaya Zemlya is. By the end of June or beginning of July the greater part of Gooseland is nearly free of snow, and soon after the Arctic flower-world develops during a few weeks all its splendour of colour. Dry, favourably situated spots are now covered by a low, but exceedingly rich

flower bed, concealed by no high grass or bushes. On moister places true grassy turf is to be met with, which, at least when seen from a distance, resembles smiling meadows.

In consequence of the loss of time which had been caused by the delay in sailing along the coast of Norway, and our stay at Maosoe, we were unable to land on this occasion, but immediately continued our course along the west coast of Novaya Zemlya towards Yugor Schar, the weather being for the most part glorious and calm. The sea was completely free of ice, and the land bare, with the exception of some small snow-fields concealed in the valleys. Here and there too along the steep strand escarpments were to be seen, remains of the winter's snow-foot, which often, when the lower stratum of air was strongly heated by the sun, were magnified by a strong mirage, so that, when seen from a distance, they resembled immense glaciers terminating perpendicularly towards the sea. Coming farther south the clear weather gave us a good view of Vaygats Island. It appears, when seen from the sea off the west coast, to form a level grassy plain, but when we approached Yugor Schar, low ridges were seen to run along the east side of the island, which are probably the last ramifications of the north spur of Ural, known by the name of Paj-koi.

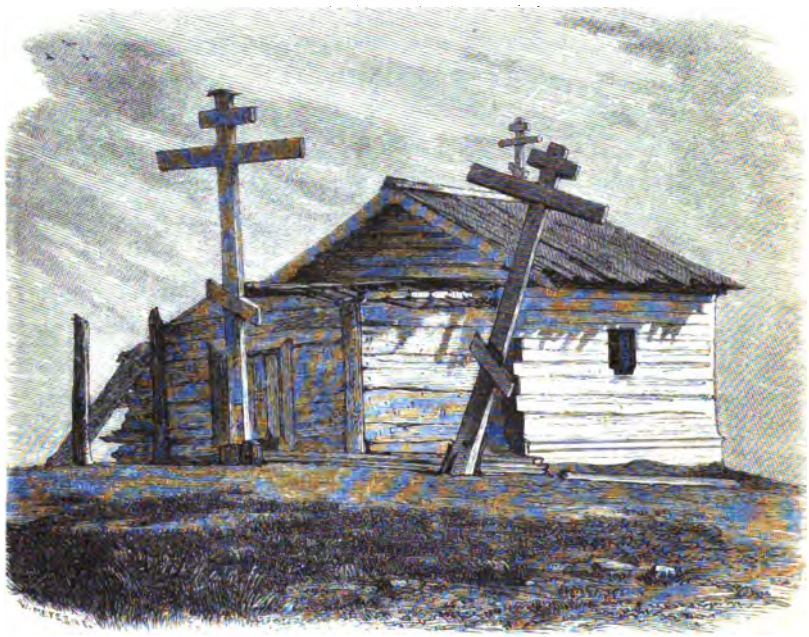
When we were off the entrance to Yugor Schar, a steamer was sighted. After much guessing, the *Fraser* was recognised. I was at first very uneasy, and feared that an accident had occurred, as the course of the vessel was exactly the opposite of that which had been fixed beforehand, but found, when Captain Nilsson soon after came on board, that he had only come out to look for us. The *Express* and the *Fraser* had been waiting for us at the appointed rendezvous since the 20th. They had left Vardoe on the 13th, and during the passage had met with as little ice as ourselves. The *Vega* and *Fraser* now made for the harbour at Chabarova, where they anchored on the evening of the 30th July with a depth of fourteen metres and

a clay bottom. The *Lena* was still wanting. We feared that the little steamer had had some difficulty in keeping afloat in the sea which had been encountered on the other side of North Cape. A breaker had even dashed over the side of the larger *Vega* and broken in pieces one of the boxes which were fastened to the deck. Our fears were unwarranted. The *Lena* had done honour to her builders at Motala works, and behaved well in the heavy sea. The delay had been caused by a compass deviation, which, on account of the slight horizontal intensity of the magnetism of the earth in these northern latitudes, was greater than that obtained during the examination made before the departure of the vessel from Gothenburg. On the 31st the *Lena* anchored alongside the other vessels, and thus the whole of our little Polar Sea squadron was collected at the appointed rendezvous.

Chabarova is a little village, situated on the mainland, south of Yugor Schar, west of the mouth of a small river in which at certain seasons fish are exceedingly abundant. During summer the place is inhabited by a number of Samoyeds, who pasture their herds of reindeer on Vaygats Island and the surrounding *tundra*, and by some Russians and Russianised Fins, who come hither from Pustosersk to carry on barter with the Samoyeds, and with their help to fish and hunt in the neighbouring sea. During winter the Samoyeds drive their herds to more southern regions, and the merchants carry their wares to Pustosersk, Mesen, Archangel, and other places. Thus it has probably gone on for centuries back, but it is only in comparatively recent times that fixed dwellings have been erected, for they are not mentioned in the accounts of the voyages of the Dutch in these regions.

The village, or "Samoyed town" as the walrus-hunters grandiosely call it, consists, like other great towns, of two portions, the town of the rich—some cabins built of wood, with flat turf-covered roofs—and the quarter of the common

people, a collection of dirty Samoyed tents. There is, besides, a little church, where, as at several places along the shore, votive crosses have been erected. The church is a wooden building, divided by a partition wall into two parts, of which the inner, the church proper, is little more than two and a half metres in height and about five metres square. On the eastern wall during



CHURCH OF CHABAROVA.
After a photograph by L. Palander.

the time the region is inhabited, there is a large number of sacred pictures placed there for the occasion by the hunters. One of them, which represented St. Nicholas, was very valuable, the material being embossed silver gilt. Before the lamps hung large dinted old copper lamps or rather light-holders, resembling inverted Byzantine cupolas, suspended by three chains.

They were set full of numerous small, and some few thick wax lights which were lighted on the occasion of our visit. Right above our landing-place there were lying a number of sledges laden with goods which the Russian merchants had procured by barter, and which were to be conveyed to Pustosersk the following autumn. The goods consisted mainly of train oil and the skins of the mountain fox, common fox, Polar bear, glutton, reindeer, and seal. The bears' skins had often a very close, white winter coat, but they were spoiled by the head and paws having been cut off. Some of the wolf skins which they showed us were very close and fine. The merchants had besides collected a considerable stock of goose quills, feathers, down, and ptarmigans' wings. For what purpose these last are used I could not learn. I was merely informed that they would be sold in Archangel. Perhaps they go thence to the dealers in fashions in Western Europe, to be afterwards used as ornaments on our ladies' hats. Ptarmigans' wings were bought as long ago as 1611 at Pustosersk by Englishmen.[1]

At the same time I saw, among the stocks of the merchants, walrus tusks and lines of walrus hide. It is noteworthy that these wares are already mentioned in Othere's narrative.

As I was not myself sufficiently master of the Russian language, I requested Mr. Serebrenikoff to make inquiries on the spot, regarding the mode of life and domestic economy of the Russians in the neighbourhood, and I have received from him the following communication on the subject:—

"The village consists of several cabins and tents. In the cabins nine Russian householders live with their servants, who are Samoyeds.[2] The Russians bring hither neither their

[1] "Letter of Richard Finch to Sir Thomas Smith, Governor; and to the rest of the Worshipful Companie of English Merchants, trading into Russia." *Purchas*, iii. p. 534.

[2] Mr. Serebrenikoff writes *Samodin* instead of *Samoyed*, considering the latter name incorrect. For *Samoyed* means "self-eater," while *Samodin*

wives nor children. In the tents the Samoyeds live with their families. The Russians are from the village Pustosersk on the Petchora river, from which they set out immediately after Easter, arriving at Chabarova about the end of May, after having traversed a distance of between 600 and 700 versts. During their stay at Chabarova they employ themselves in the management of reindeer, in catching whales, and in carrying on barter with the Samoyeds. They bring with them from home all their household articles and commercial wares on sledges drawn by reindeer, and as there is a poor ruinous chapel there, they bring also pictures of St. Nicholas and other saints. The holy Nicholas also figures as a shareholder in a company for the capture of whales. Part of their reindeer is left during summer on Vaygats, and after their arrival at Chabarova they still pass over on the ice to that island. Towards the close of August, when the cold commences, the reindeer are driven across Yugor Schar from Vaygats to the mainland. About the 1st October, old style, the Russians return with their reindeer to Pustosersk. Vaygats Island is considered by them to afford exceedingly good pasturage for reindeer; they therefore allow a number of them to winter on the island under the care of some Samoyed families, and this is considered the more advantageous, as the reindeer there are never stolen. Such thefts, on the contrary, are often committed by the Samoyeds on the mainland. For thirty years back the Siberian plague has raged severely among the reindeer. A Russian informed me that he now owned but two hundred, while some years ago he had a thousand; and this statement was confirmed by the other Russians. Men too are attacked by this disease. Two or three days before our arrival a Samoyed and his wife had eaten the flesh of a diseased animal, in consequence of which the woman died the following day, and the man still lay ill, and, as the people on the spot said, would not probably survive. Some of

denotes "an individual," "one who cannot be mistaken for any other," and, as the Samoyeds never were cannibals, Mr. Serebrenikoff gives a preference to the latter name, which is used by the Russians at Chabarova, and appears to be a literal translation of the name which the Samoyeds give themselves. I consider it probable, however, that the old tradition of man-eaters (*androphagi*) living in the north, which originated with Herodotus, and was afterwards universally adopted in the geographical literature of the middle ages, reappears in a Russianised form in the name "Samoyed." (Compare what is quoted further on from Giles Fletcher's narrative).

the Samoyeds are considered rich, for instance the 'eldest' (starschina) of the tribe, who owns a thousand reindeer. The Samoyeds also employ themselves, like the Russians, in fishing. During winter some betake themselves to Western Siberia, where 'corn is cheap,' and some go to Pustosersk.

"The nine Russians form a company (artell) for whale-fishing. There are twenty-two shares, two of which fall to the holy Nicholas, and the other twenty are divided among the shareholders. The company's profit for the fishing season commonly amounts to 1,500 or 2,000 pood train oil of the white whale (*Beluga*), but this season there had been no fishing on account of disagreements among the shareholders. For in the Russian 'artell' the rule is, 'equal liability, equal rights,' and as the rich will never comply with the first part of the rule, it was their arrogance and greed which caused contention here, as everywhere else in the world.

"Neither the Russians nor the Samoyeds carry on any agriculture. The former buy meal for bread from Irbit. The price of meal varies; this season it costs one rouble ten copecks per pood in Pustosersk. Salt is now brought from Norway to Mesen, where it costs fifty to sixty copecks per pood. The Samoyeds buy nearly everything from the Russians. There were many inquiries for gunpowder, shot, cheap fowling-pieces, rum, bread, sugar, and culinary vessels (teacups, &c.). The Samoyed women wear clothes of different colours, chiefly red. In exchange for the goods enumerated above there may be obtained fish, train oil, reindeer skins, walrus tusks, and furs, viz., the skins of the red, white, and brown fox, wolf, Polar bear, and glutton.

"The Russians in question are 'Old Believers,' but the difference between them and the orthodox consists merely in their not smoking tobacco, and in their making the sign of the cross with the thumb, the ring finger, and the little finger, while the orthodox Russians, on the other hand, make it with the thumb, the forefinger, and the middle finger. All Samoyeds are baptised into the orthodox faith, but they worship their old idols at the same time. They travel over a thousand versts as pilgrims to their sacrificial places. There are several such places on Vaygats, where their idols are to be found. The Russians call these idols 'bolvany.'[1] Both the Russians and Samoyeds are very tolerant in regard to matters of faith. The

[1] This name, which properly denotes a coarse likeness, has passed into the Swedish, the word *bulvan* being one of the few which that language has borrowed from the Russian.

Russians, for instance, say that the Samoyeds attribute to their 'bolvans' the same importance which they themselves attach to their sacred pictures, and find in this nothing objectionable. The Samoyeds have songs and sagas, relating among other things to their migrations.

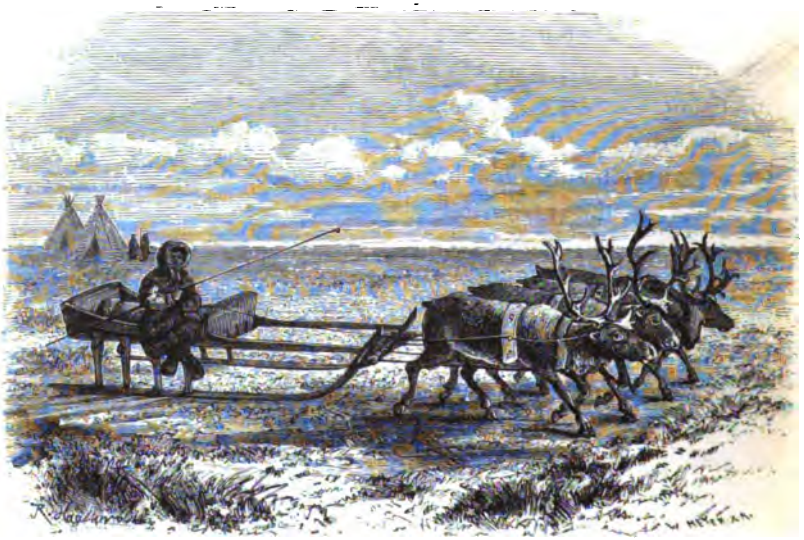
"The Samoyed has one or more wives; even sisters may marry the same man. Marriage is entered upon without any solemnity. The wives are considered by the men as having equal rights with themselves, and are treated accordingly, which is very remarkable, as the Russians, like other Christian nations, consider the woman as in certain respects inferior to the man."

I visited the place for the first time in the beginning of August, 1875. It was a Russian holiday, and, while still a long way off at sea, we could see a large number of Russians and Samoyeds standing in groups on the beach. Coming nearer we found them engaged in playing various different games, and though it was the first time in the memory of man that European gentlemen had visited their "town," they scarcely allowed themselves to be more disturbed in their occupation than if some stranger Samoyeds had suddenly joined their company. Some stood in a circle and by turns threw a piece of iron, shaped somewhat like a marlinspike, to the ground; the art consisting in getting the sharp end to strike it just in front of rings placed on the ground, in such a way that the piece of iron remained standing. Others were engaged in playing a game resembling our nine-pins; others, again, in wrestling, &c. The Russians and Samoyeds played with each other without distinction. The Samoyeds, small of stature, dirty, with matted, unkempt hair, were clad in dirty summer clothes of skin, sometimes with a showy-coloured cotton shirt drawn over them; the Russians (probably originally of the Finnish race and descendants of the old Beormas) tall, well-grown, with long hair shining with oil, ornamentally parted, combed, and frizzled, and held together by a head band, or covered with a cap resembling that shown in the accompanying

woodcut, were clad in long variegated blouses, or "mekkor," fastened at the waist with a belt. Notwithstanding the feigned indifference shown at first, which was evidently considered good manners, we were received in a friendly way. We were first invited to try our luck and skill in the game in turn with the rest, when it soon appeared, to the no small gratification of our hosts, that we were quite incapable of entering into competition either with Russian or Samoyed. Thereupon one of the Russians invited us to enter his cabin, where we were entertained with tea, Russian wheaten cakes of unfermented dough, and brandy. Some small presents were given us with a naïve notification of what would be welcome in their stead, a notification which I with pleasure complied with as far as my resources permitted. A complete unanimity at first prevailed between our Russian and Samoyed hosts, but on the following day a sharp dispute was like to arise because the former invited one of us to drive with a reindeer team standing in the neighbourhood of a Russian hut. The Samoyeds were much displeased on this account, but declared at the same time, as well as they could by signs, that they themselves were willing to drive us, if we so desired, and they showed that they were serious in their declaration by there and then breaking off the quarrel in order to take a short turn with their reindeer teams at a rapid rate among the tents.

SAMOYED WOMAN'S HOOD.
One-eighth of natural size.

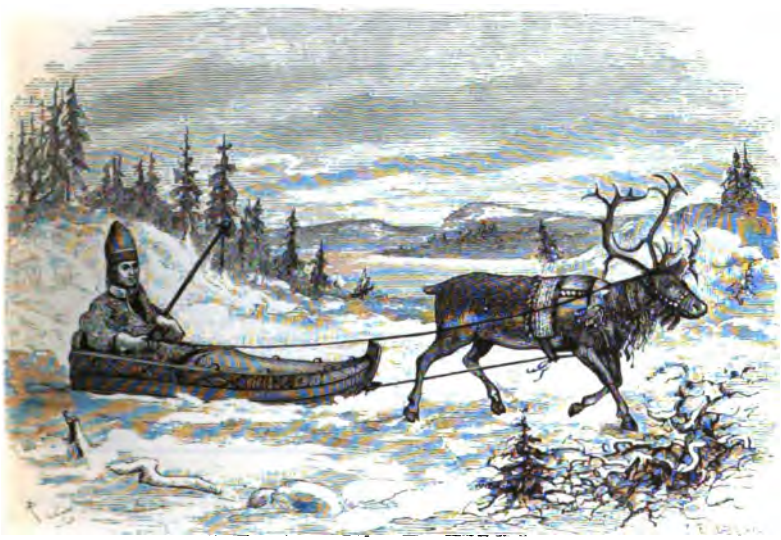
The Samoyed sleigh is intended both for winter travelling on the snow, and for summer travelling on the mosses and water-drenched bogs of the *tundra*. They are, therefore, constructed quite differently from the "akja" of the Lapp. As the woodcut below shows, it completely resembles a high sledge, the carriage consisting of a low and short box, which, in convenience, style, and warmth, cannot be compared to the



SAMOYED SLEIGH.
After a drawing by Hj. Theel.

well-known equipage of the Lapps. We have here two quite different types of sleighs. The Lapp "akja" appears from time immemorial to have been peculiar to the Scandinavian north; the high sleigh, on the contrary, to northern Russia. Thus we find "akjas" of the kind still in common use, delineated in Olaus Magnus (Rome edition, 1555, page 598); Samoyed sleighs, again, in the first works we have on

those regions, for instance, in HUYGHEN VAN LINSCHOTEN'S *Schip-vaert van by Noorden*, &c., Amsterdam, 1601, as a side drawing on the principal map. Such high sleighs are also used on the Kanin peninsula, on Yalmal, and in Western Siberia. The sleighs of the Chukchis, on the other hand, as will be seen by a drawing given farther on, are lower, and thus more resemble our "kaelkar," or work-sledges.

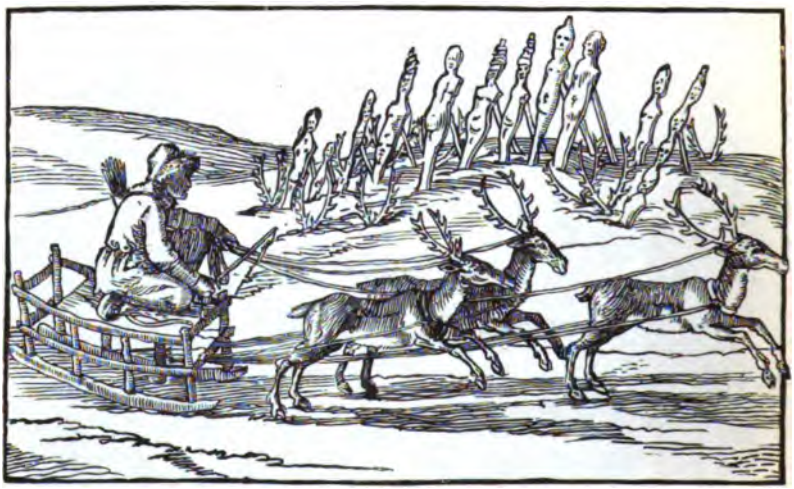


LAPP AKJA.
After original in the Northern Museum, Stockholm.

The neighbourhood of the tents swarmed with small black or white long-haired dogs, with pointed nose and pointed ears. They are used exclusively for tending the herds of reindeer, and appear to be of the same race as the "renvallhund," the reindeer dog. At several places on the coast of the White Sea, however, dogs are also employed as beasts of draught, but according to information which I procured before my departure for

Spitzbergen in 1872—it was then under discussion whether dogs should be used during the projected ice journey—these are of a different race, larger and stronger than the Lapp or Samoyed dogs proper.

Immediately after the *Vega* came to anchor, I went on land on this occasion also; in the first place with a view to take some



Samoiedarum, trahis a rangiferis protractis insidentium. Nec non Idolorum ab ijsdem cultorum effigies.

SAMOYED SLEIGH AND IDOLS.

After an old Dutch engraving.

solar altitudes, in order to ascertain the chronometer's rate of going; for during the voyage of 1875 I had had an opportunity of determining the position of this place as accurately as is possible with the common reflecting circle and chronometer, with the following result:—

The Church at Chabarova { Latitude 69° 38′ 50″. Longitude 60° 19′ 49″ E. from Greenwich.

When the observations were finished I hastened to renew my acquaintance with my old friends on the spot. I also endeavoured to purchase from the Samoyeds dresses and household articles; but as I had not then with me goods for barter, and ready money appeared to be of small account with them, prices were very high; for instance, for a lady's beautiful "pesk," twenty roubles; for a cap with brass ornaments, ten roubles; for a pair of boots of reindeer skin, two roubles; for copper ornaments for hoods, two roubles each; and so on.

As I knew that the Samoyeds during their wanderings always carry idols with them, I asked them whether they could

SAMOYED IDOLS.
One-third of natural size.

not sell me some. All at first answered in the negative. It was evident that they were hindered from complying with my requests partly by superstition, partly by being a little ashamed, before the West European, of the nature of their gods. The metallic lustre of some rouble pieces which I had procured in Stockholm, however, at last induced an old woman to set aside all fears. She went to one of the loaded sledges, which appeared to be used as magazines, and searched for a long time till she got hold of an old useless skin boot, from which she drew a fine skin stocking, out of which at last four idols appeared. After

further negotiations they were sold to me at a very high price. They consisted of a miniature "pesk," with belt, without body; a skin doll thirteen centimetres long, with face of brass; another doll, with a bent piece of copper plate for a nose; and a stone,

SAMOYED HAIR ORNAMENTS.
One-third of natural size.

wrapped round with rags and hung with brass plates, a corner of the stone forming the countenance of the human figure it was intended to resemble.

More finely-formed gods, dolls pretty well made, with bows

forged of iron, I have seen, but have not had the good fortune to get possession of. In the case now in question the traffic was facilitated by the circumstance that the old witch, Anna Petrovna, who sold her gods, was baptised, which was naturally taken advantage of by me to represent to her that it was wrong for her as a Christian to worship such trash as "bolvans," and the necessity of immediately getting rid of them. But my arguments, at once sophistic and egoistic, met with disapproval, both from the Russians and Samoyeds standing round, inasmuch as they declared that on the whole there was no great difference between the "bolvan" of the Samoyed and the sacred picture of the Christian. It would even appear as if the Russians themselves considered the "bolvans" as representatives of some sort of Samoyed saints in the other world.

When the traffic in gods was finished, though not to my full satisfaction, because I thought I had got too little, we were invited by one of the Russians, as in 1875, to drink tea in his cabin. This consisted of a lobby, and a room about four metres square, and scarcely two metres and a half high. One corner was occupied by a large chimney, at the side of which was the very low door, and right opposite the window opening, under which were placed some chests, serving as tea-table for the occasion. Along the two remaining sides of the room there were fastened to the wall, sleeping places of boards covered with reindeer skin. The window appeared to have been formerly filled with panes of glass, but most of these were now broken, and replaced by boards. It need scarcely surprise us if glass is a scarce article of luxury here.

We had no sooner entered the cabin than preparations for tea commenced. Sugar, biscuits, teacups and saucers, and a brandy flask were produced from a common Russian travelling trunk. Fire was lighted, water boiled, and tea made in the common way, a thick smoke and strong fumes from the burning fuel spreading in the upper part of the low room, which for the

time was packed full of curious visitors. Excepting these trifling inconveniences the entertainment passed off very agreeably, with constant conversation, which was carried on with great liveliness, though the hosts and most of the guests could only with difficulty make themselves mutually intelligible.

Hence we betook ourselves to the skin tents of the Samoyeds which stood apart from the wooden huts inhabited by the Russians. Here too we met with a friendly reception. Several of the inhabitants of the tents were now clad with somewhat greater care in a dress of reindeer skin, resembling that of the Lapps. The women's holiday dress was particularly showy. It consisted of a pretty long garment of reindeer skin, fitting closely at the waist, so thin that it hung from the middle in beautiful regular folds. The petticoat has two or three differently coloured fringes of dogskin, between which stripes of brightly coloured cloth are sewed on. The foot-covering consists of boots of reindeer skin beautifully and tastefully embroidered. During summer the men go bare-headed. The women then have their black straight hair divided behind into two tresses, which are braided with straps, variegated ribbons and pearls, which are continued beyond the point where the hair ends as an artificial prolongation of the braids, so that, including the straps which form this continuation, loaded as they are with pearls, buttons, and metal ornaments of all kinds, they nearly reach the ground. The whole is so skilfully done, that at first one is inclined to believe that the women here were gifted with a quite incredible growth of hair. A mass of other bands of pearls ornamented with buttons was besides often intertwined with the hair in a very tasteful way, or fixed to the perforated ears. All this hair ornamentation is naturally very heavy, and the head is still more weighed down in winter, as it is protected from the cold by a thick and very warm cap of reindeer skin, bordered with dogskin, from the back part of which hang down two straps set full of heavy plates of brass or copper.

The young woman also, even here as everywhere else, bedecks herself as best she can; but fair she certainly is not in our eyes. She competes with the man in dirt. Like the man she is small of stature, has black coarse hair resembling that of a horse's

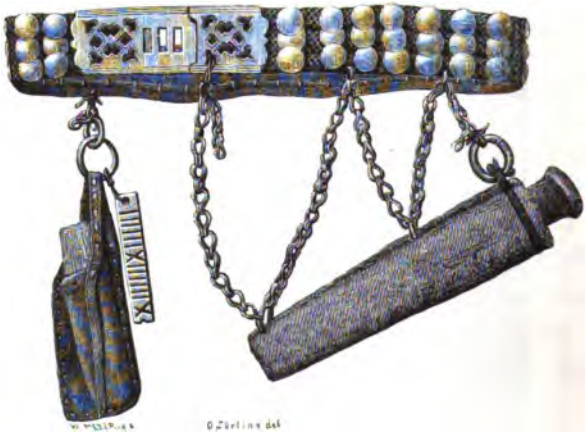
SAMOYED WOMAN'S DRESS.

After a drawing by Hj. Theel.

mane or tail, face of a yellow colour, often concealed by dirt, small, oblique, often running and sore eyes, a flat nose, broad projecting cheekbones, slender legs and small feet and hands.

The dress of the man, which resembles that of the Lapps, consists of a plain, full and long "pesk," confined at the waist with a belt richly ornamented with buttons and brass mounting, from which the knife is suspended. The boots of reindeer skin commonly go above the knees, and the head covering consists of a closely fitting cap, also of reindeer skin.

The summer tents, the only ones we saw, are conical, with a hole in the roof for carrying off the smoke from the fireplace, which is placed in the middle of the floor. The sleeping

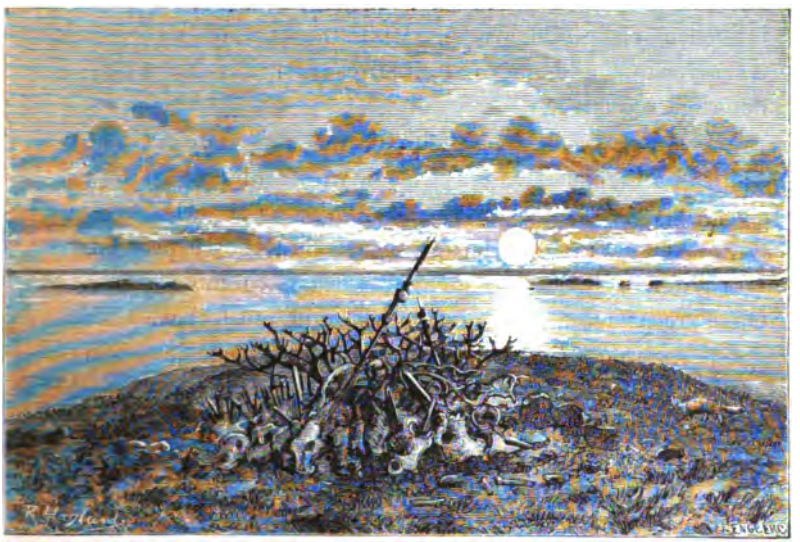


SAMOYED BELT WITH KNIFE.
One-sixth of natural size.

places in many of the tents are concealed by a curtain of variegated cotton cloth. Such cloth is also used, when there is a supply of it, for the inner parts of the dress. Skin, it would appear, is not a very comfortable material for dress, for the first thing, after fire-water and iron, which the skin-clad savage purchases from the European, is cotton, linen, or woollen cloth.

Of the Polar races, whose acquaintance I have made, the reindeer Lapps undoubtedly stand highest; next to them come the Eskimo of Danish Greenland. Both these races are

Christian and able to read, and have learned to use and require a large number of the products of agriculture, commerce, and the industrial arts of the present day, as cotton and woollen cloth, tools of forged and cast iron, firearms, coffee, sugar, bread, &c. They are still nomads and hunters, but cannot be called savages; and the educated European who has lived among them for a considerable time commonly acquires a liking for many points of



SACRIFICIAL EMINENCE ON VAYGATS ISLAND.
After a drawing by A. Hovgaard.

their natural disposition and mode of life. Next to them in civilisation come the Eskimo of North-western America, on whose originally rough life contact with the American whale-fishers appears to have had a very beneficial influence. I form my judgment from the Eskimo tribe at Port Clarence. The members of this tribe were still heathens, but a few of them were far travelled, and had brought home from the Sandwich

Islands not only cocoa-nuts and palm mats, but also a trace of the South Sea islander's greater love for ornament and order. Next come the Chukchis, who have as yet come in contact with men of European race to a limited extent, but whose resources appear to have seriously diminished in recent times, in consequence of which the vigour and vitality of the tribe have decreased to a noteworthy extent. Last of all come the Samoyeds, or at least the Samoyeds who inhabit regions bordering on countries inhabited by the Caucasian races; on them the influence of the higher race, with its regulations and ordinances, its merchants, and, above all, its fire-water, has had a distinctly deteriorating effect.

When I once asked an Eskimo in North-western Greenland, known for his excessive self-esteem, whether he would not admit that the Danish Inspector (Governor) was superior to him, I got for answer: "That is not so certain: the Inspector has, it is true, more property, and appears to have more power, but there are people in Copenhagen whom he must obey. I receive orders from none." The same haughty self-esteem one meets with in his host in the "gamma" of the reindeer Lapp, and the skin tent of the Chukchi. In the Samoyed, on the other hand, it appears to have been expelled by a feeling of inferiority and timidity, which in that race has deprived the savage of his most striking characteristics.

I knew from old travels and from my own experience on Yalmal, that another sort of gods, and one perhaps inferior to those which Anna Petrovna pulled out of her old boot, was to be found set up at various places on eminences strewn with the bones of animals that had been offered in sacrifice. Our Russian host informed us the Samoyeds from far distant regions are accustomed to make pilgrimages to these places in order to offer sacrifices and make vows. They eat the flesh of the animals they sacrifice, the bones are scattered over the sacrificial height, and the idols are besmeared with the blood of

the sacrificed animal. I immediately declared that I wished to visit such a place. But for a long time none of the Russians who were present was willing to act as guide. At last however a young man offered to conduct me to a place on Vaygats Island, where I could see what I wished. Accordingly the following day, accompanied by Dr. Almquist, Lieutenant Hovgaard, Captain Nilsson, and my Russian guide, I made an excursion in one of the steam launches to the other shore of Yugor Straits.

The sacrificial eminence was situated on the highest point of the south-western headland of Vaygats Island, and consisted of a natural hillock which rose a couple of metres above the surrounding plain. The plain terminated towards the sea with a steep escarpment. The land was even, but rose gradually to a height of eighteen metres above the sea. The country consisted of upright strata of Silurian limestone running from east to west, and at certain places containing fossils resembling those of Gotland. Here and there were shallow depressions in the plain, covered with a very rich and uniformly green growth of grass. The high-lying dry parts again made a gorgeous show, covered as they were with an exceedingly luxuriant carpet of yellow and white saxifrages, blue *Eritrichia*, *Polemonia* and *Parryæ*, and yellow *Chrysosplenia*, &c. The last named, commonly quite modest flowers, are here so luxuriant that they form an important part of the flower covering. Trees are wholly wanting. Even bushes are scarcely two feet high, and that only at sheltered places, in hollows and at the foot of steep slopes looking towards the south. The sacrificial mound consisted of a cairn of stones some few metres square, situated on a special elevation of the plain. Among the stones there were found:—

1. Reindeer skulls, broken in pieces for the purpose of extracting the brains, but with the horns still fast to the coronal bone; these were now so arranged among the stones

that they formed a close thicket of reindeer horns, which gave to the sacrificial mound its peculiar character.

2. Reindeer skulls with the coronal bone bored through, set up on sticks which were stuck in the mound. Sometimes there was carved on these sticks a number of faces, the one over the other.

IDOLS FROM THE SACRIFICIAL CAIRN.
One-twelfth of natural size.

3. A large number of other bones of reindeer, among them marrow bones, broken for the purpose of extracting the marrow.

4. Bones of the bear, among which were observed the paws and the head, only half flayed, of a bear which had been shot so recently that the flesh had not begun to decompose; alongside of this bear's head there were found two lead bullets placed on a stone.

5. A quantity of pieces of iron, for instance, broken axes, fragments of iron pots, metal parts of a broken harmonicon, &c.; and finally,

6. The mighty beings to which all this splendour was offered.

They consisted of hundreds of small wooden sticks, the upper portions of which were carved very clumsily in the form of the human countenance, most of them from fifteen to twenty, but some of them 370 centimetres in length. They were all stuck in the ground on the south-east part of the eminence. Near the place of sacrifice there were to be seen pieces of driftwood and remains of the fireplace at which the sacrificial meal was prepared. Our guide told us that at these meals the mouths of the idols were besmeared with blood and

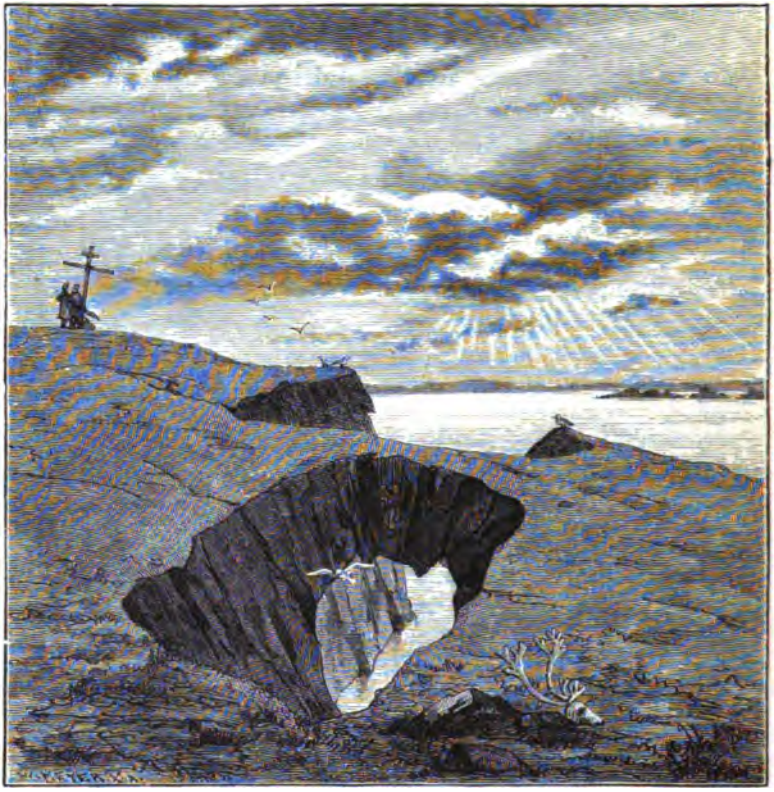
wetted with brandy, and the former statement was confirmed by the large spots of blood which were found on most of the large idols below the holes intended to represent the mouth.

After a drawing had been made of the mound, we robbed it discreetly, and put some of the idols and the bones of the animals offered in sacrifice into a bag which I ordered to be carried down to the boat. My guide now became evidently uncomfortable, and said that I ought to propitiate the wrath of the "bolvans" by myself offering something. I immediately said that I was ready to do that, if he would only show me how to go to work. A little at a loss, and doubting whether he ought to be more afraid of the wrath of the "bolvans" or of the punishment which in another world would befal those who had sacrificed to false gods, he replied that it was only necessary to place some small coins among the stones. With a solemn countenance I now laid my gift upon the cairn. It was certainly the most precious thing that had ever been offered there, consisting as it did of two silver pieces. The Russian was now satisfied, but declared that I was too lavish, "a couple of copper coins had been quite enough."

The following day the Samoyeds came to know that I had been shown their sacrificial mound. For their own part they appeared to attach little importance to this, but they declared that the guide would be punished by the offended "bolvans." He would perhaps come to repent of his deed by the following autumn, when his reindeer should return from Vaygats Island, where they for the present were tended by Samoyeds; indeed if punishment did not befall him now, it would reach him in the future and visit his children and grandchildren—certain it was that the gods would not leave him unpunished. In respect to God's wrath their religious ideas were thus in full accordance with the teaching of the Old Testament.

This place of sacrifice was besides not particularly old, for

there had been an older place situated 600 metres nearer the shore, beside a grotto which was regarded by the Samoyeds with superstitious veneration. A larger number of wooden idols had been set up there, but about thirty years ago a



SACRIFICIAL CAVITY ON VAYGATS ISLAND.
After a drawing by A. Hovgaard.

zealous, newly-appointed, and therefore clean-sweeping archimandrite visited the place, set fire to the sacrificial mound, and in its place erected a cross, which is still standing. The Samoyeds had not sought to retaliate by destroying in their

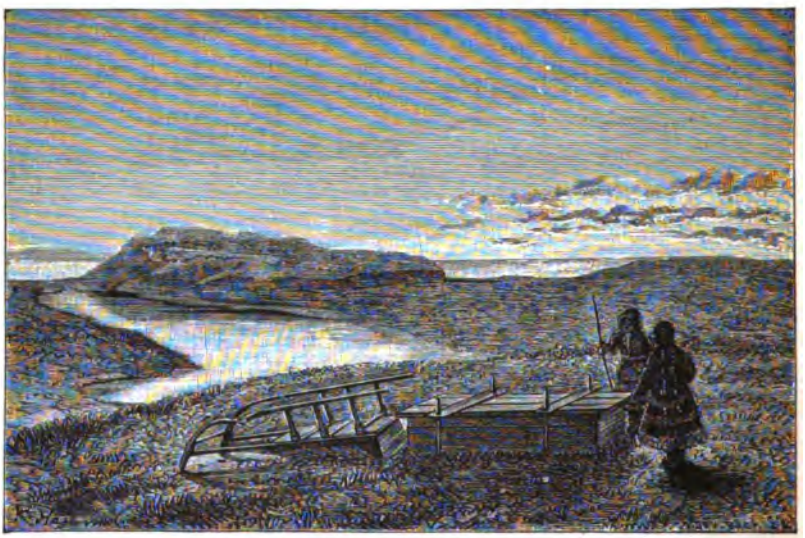
turn the symbol of Christian worship. They left revenge to the gods themselves, certain that in a short time they would destroy all the archimandrite's reindeer, and merely removed their own place of sacrifice a little farther into the land. There no injudicious religious zeal has since attacked their worship of the "bolvans."

The old place of sacrifice was still recognisable by the number of fragments of bones and rusted pieces of iron which lay strewed about on the ground, over a very extensive area, by the side of the Russian cross. Remains of the fireplace, on which the Schaman gods had been burned, were also visible. These had been much larger and finer than the gods on the present eminence, which is also confirmed by a comparison of the drawings here given of the latter with those from the time of the Dutch explorers. The race of the Schaman gods has evidently deteriorated in the course of the last three hundred years.

After I had completed my examination and collected some contributions from the old sacrificial mound I ordered a little boat, which the steam-launch had taken in tow, to be carried over the sandy neck of land which separates the lake shown on the map from the sea, and rowed with Captain Nilsson and my Russian guide to a Samoyed burying-place farther inland by the shore of the lake.

Only one person was found buried at the place. The grave was beautifully situated on the sloping beach of the lake, now gay with numberless Polar flowers. It consisted of a box carefully constructed of broad stout planks, fixed to the ground with earthfast stakes and cross-bars, so that neither beasts of prey nor lemmings could get through. The planks appeared not to have been hewn out of drift-wood, but were probably brought from the south, like the birch bark with which the bottom of the coffin was covered. As a "pesk," now fallen in pieces, lying round the skeleton, and various rotten rags showed,

the dead body had been wrapped in the common Samoyed dress. In the grave were found besides the remains of an iron pot, an axe, knife, boring tool, bow, wooden arrow, some copper ornaments, &c. Rolled-up pieces of bark also lay in the coffin, which were doubtless intended to be used in lighting fires in another world. Beside the grave lay a sleigh turned upside down, evidently placed there in order that the dead man should



SAMOYED GRAVE ON VAYGATS ISLAND.

not, away there, want a means of transport, and it is probable that reindeer for drawing it were slaughtered at the funeral banquet.

As it may be of interest to ascertain to what extent the Samoyeds have undergone any considerable changes in their mode of life since they first became known to West-Europeans, I shall here quote some of the sketches of them which we

find in the accounts of the voyages of the English and Dutch travellers to the North-East.

That changes have taken place in their weapons, in other words, that the Samoyeds have made progress in the art of war or the chase, is shown by the old drawings, some of which are here reproduced. For in these they are nearly always delineated with bows and arrows. Now the bow appears to

SAMOYED-ARCHERS.
After Linschoten.

have almost completely gone out of use, for we saw not a single Samoyed archer. They had, on the other hand, the wretched old flint firelocks, in which lost pieces of the lock were often replaced in a very ingenious way with pieces of bone and thongs. They also inquired eagerly for percussion guns, but breechloaders were still unknown to them. In this

respect they had not kept abreast of the times so well as the Eskimo at Port Clarence.

One of the oldest accounts of the Samoyeds which I know is that of Stephen Burrough from 1556. It is given in Hakluyt (1st edition, page 318). In the narrative of the voyage of the *Searchthrift* we read:—

"On Saturday the 1st August 1556 I went ashore,[1] and there saw three morses that they (Russian hunters) had killed: they held one tooth of a morse, which was not great, at a roble, and one white beare skin at three robles and two robles: they further told me, that there were people called Samoeds on the great Island, and that they would not abide them nor us, who have no houses, but only coverings made of Deerskins, set ouer them with stakes: they are men expert in shooting, and have great plenty of Deere. On Monday the 3rd we weyed and went roome with another Island, which was five leagues (15') East-north-east from us: and there I met againe with Loshak,[2] and went on shore with him, and he brought me to a heap of Samoeds idols, which were in number above 300, the worst and the most unartificiall worke that ever I saw: the eyes and mouthes of sundrie of them were bloodie, they had the shape of men, women, and children, very grosly wrought, and that which they had made for other parts, was also sprinkled with blood. Some of their idols were an olde sticke with two or three notches, made with a knife in it. There was one of their sleds broken and lay by the heape of idols, and there I saw a deers skinne which the foules had spoyled: and before certaine of their idols blocks were made as high as their mouthes, being all bloody, I thought that to be the table whereon they offered their sacrifice: I saw also the instruments whereupon they had roasted flesh, and as farre as I could perceiue, they make the fire directly under the spit. Their boates are made of Deers skins, and when they come on shoare they cary their boates with them upon their backs: for their cariages they haue no other beastes to serve them but Deere only. As for bread and corne they have none, except the Russes

[1] Probably on one of the small islands near Vaygats.

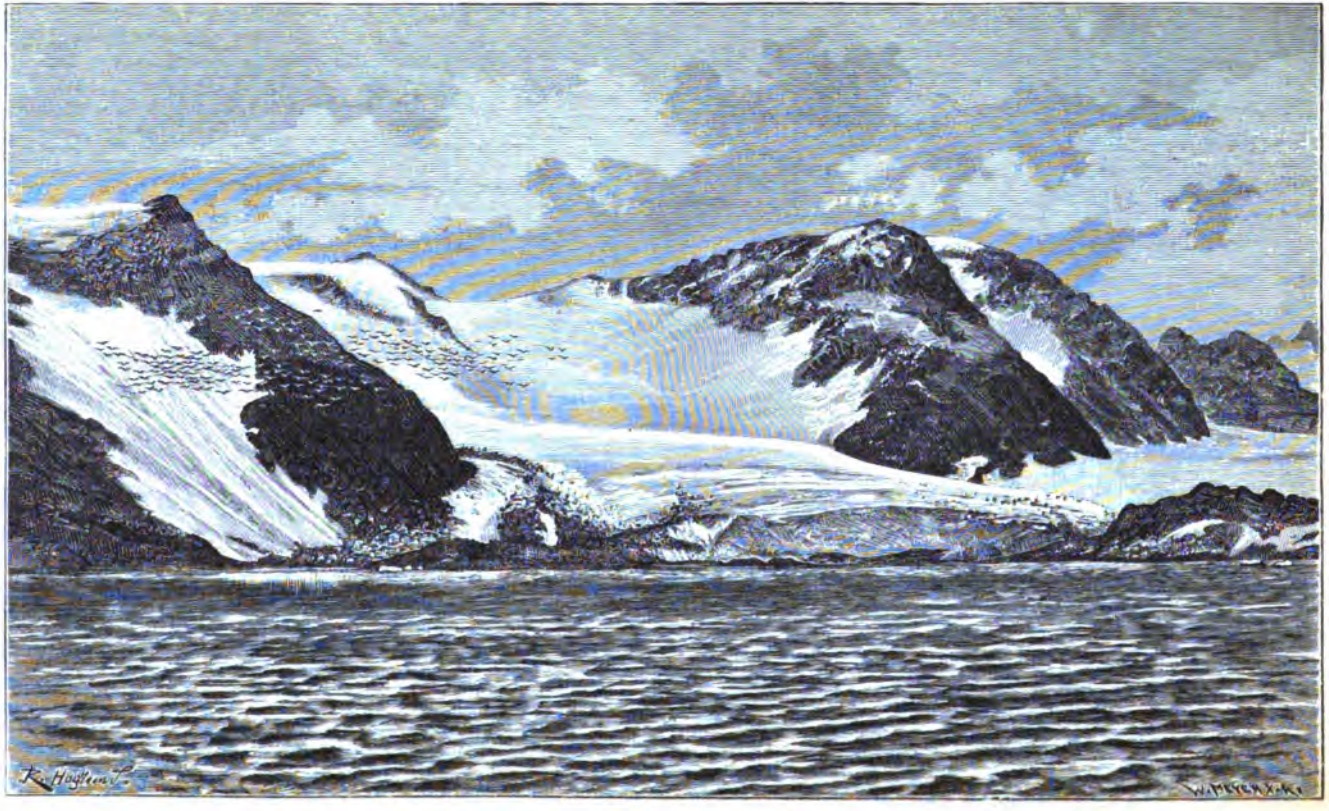
[2] A Russian hunter who had been serviceable to Stephen Burrough in many ways.

relations to other races have been much discussed. On this subject I have received from my learned friend, the renowned philologist Professor AHLQUIST of Helsingfors the following communication :—

The Samoyeds are reckoned, along with the Tungoose, the Mongolian, the Turkish and the Finnish-Ugrian races, to belong to the so-called Altaic or Ural-Altaic stem. What is mainly characteristic of this stem, is that all the languages occurring within it belong to the so-called agglutinating type. For in these languages the relations of ideas are expressed exclusively by terminations or suffixes—inflections, prefixes and prepositions, as expressive of relations, being completely unknown to them. Other peculiarities characteristic of the Altaic languages are the vocal harmony occurring in many of them, the inability to have more than one consonant in the beginning of a word, and the expression of the plural by a peculiar affix, the case terminations being the same in the plural as in the singular. The affinity between the different branches of the Altaic stem is thus founded mainly on analogy or resemblance in the construction of the languages, while the different tongues in the material of language (both in the words themselves and in the expression of relations) show a very limited affinity or none at all. The circumstance that the Samoyeds for the present have as their nearest neighbours several Finnish-Ugrian races (Lapps, Syrjaeni, Ostjaks, and Voguls), and that these to a great extent carry on the same modes of life as themselves, has led some authors to assume a close affinity between the Samoyeds and the Fins and the Finnish races in general. The speech of the two neighbouring tribes however affords no ground for such a supposition. Even the language of the Ostjak, which is the most closely related to that of the Samoyeds, is separated heaven-wide from it and has nothing in common with it, except a small number of borrowed words

Delle navigationi e viaggi, ii. 1583, leaf 236). At another place in the same work it is said that "the land Comania has on the north immediately after Russia, the Mordvini and Bileri, *i.e.* the Great Bulgarians, the Bascarti, *i.e.* the Great Hungarians, then the Parositi and *Samogedi*, who are said to have the faces of dogs" (*Relation des Mongols*, p. 351. Ramusio, ii., leaf 239).

(chiefly names of articles from the Polar nomad's life), which the Ostjak has taken from the language of his northern neighbour. With respect to their language, however, the Samoyeds are said to stand at a like distance from the other branches of the stem in question. To what extent craniology or the modern anthropology can more accurately determine the affinity-relationship of the Samoyed to other tribes, is still a question of the future.



BREEDING-PLACE FOR LITTLE AUKS.

Faul Bay, on the West Coast of Spitzbergen

CHAPTER III.

From the Animal World of Novaya Zemlya—The Fulmar Petrel—The Rotge or Little Auk—Brünnich's Guillemot—The Black Guillemot—The Arctic Puffin—The Gulls—Richardson's Skua—the Tern—Ducks and Geese—The Swan—Waders—The Snow Bunting—The Ptarmigan—The Snowy Owl—The Reindeer—The Polar Bear—The Mountain Fox—The Lemming—Insects—The Walrus—The Seal—Whales.

If we do not take into account the few Samóyeds who of recent years have settled on Novaya Zemlya or wander about during summer on the plains of Vaygats Island, all the lands which in the old world have formed the field of research of the Polar explorer—Spitzbergen, Franz-Josef Land, Novaya Zemlya, Vaygats Island, the Taimur Peninsula, the New Siberian Islands, and perhaps Wrangel's Land also—are uninhabited. The pictures of life and variety, which the native, with his peculiar manners and customs, commonly offers to the foreigner in distant foreign lands, are not to be met with here. But, instead, the animal life, which he finds there in summer—for during winter almost all beings who live above the surface of the sea disappear from the highest North—is more vigorous and perhaps even more abundant, or, to speak more correctly, less concealed by the luxuriance of vegetation than in the south.

It is not, however, the larger mammalia—whales, walruses, seals, bears and reindeer—that attract attention in the first place, but the innumerable flocks of birds that swarm around the Polar traveller during the long summer day of the North.

Long before one enters the region of the Polar Sea proper, the vessel is surrounded by flocks of large grey birds which fly, or rather hover without moving their wings, close to the surface of the sea, rising and sinking with the swelling of the billows, eagerly searching for some eatable object on the surface of the water, or swim in the wake of the vessel in order to snap up any scraps that may be thrown overboard. It is the Arctic *stormfogel*[1] (Fulmar, "Mallemuck," "Hafhaest," *Procellaria glacialis*, L.). The fulmar is bold and voracious, and smells villanously, on which account it is only eaten in cases of necessity, although its flesh, if the bird has not recently devoured too much rotten blubber, is by no means without relish, at least for those who have become accustomed to the flavour of train oil, when not too strong. It is more common on Bear Island and Spitzbergen than on Novaya Zemlya, and scarcely appears to breed in any considerable numbers on the last-named place. I know three places north of Scandinavia where the fulmar breeds in large numbers: the first on Bear Island, on the slopes of some not very steep cliffs near the so-called south harbour of the island,[2] the second on the southern shore of Brandywine Bay on North-East Land, the third on ledges of the perpendicular rock-walls in the interior of Ice Fjord. At the two latter places the nests are inaccessible. On Bear Island, on the other hand, one can without very great difficulty plunder the whole colony of the dirty grey, short eggs, which are equally

[1] The name *stormfogel* is also used for the Stormy Petrel (*Thalassidroma pelagica*, Vig.). This bird does not occur in the portions of the Polar Sea with which we are now concerned.

[2] At Bear Island, Tobiesen, on the 28th May, 1866, saw fulmars' eggs laid immediately on the ice which still covered the rock. At one place a bird sitting on its eggs was even frozen fast by one leg to the ice on the $\frac{3}{4}$ August, 1596. Barents found on the north part of Novaya Zemlya that some fulmars had chosen as a hatching-place a piece of ice covered with a little earth. In both these cases the under part of the egg during hatching could never be warmed above the freezing-point.

rounded at both ends. The eggs taste exceedingly well. The nest is very inconsiderable, smelling badly like the bird itself.

When the navigator has gone a little further north and come to an ice-bestrewed sea, the swell ceases at once, the wind is hushed and the sea becomes bright as a mirror, rising and sinking with a slow gentle heaving. Flocks of little auks (*Mergulus alle*, L.) Brünnich's guillemots (*Uria Brünnichii*, Sabine), and black guillemots (*Uria grylle*, L.) now swarm in the air and swim among the ice floes. The *alke-kung* (little auk), also called the "sea king," or rotge, occurs only sparingly off the southern part of Novaya Zemlya, and does not, so far as I know, breed there. The situation of the land is too southerly, the accumulations of stones along the sides of the mountains too inconsiderable, for the thriving of this little bird. But on Spitzbergen it occurs in incredible numbers, and breeds in the talus, 100 to 200 metres high, which frost and weathering have formed at several places on the steep slopes of the coast mountain sides; for instance, at Horn Sound, at Magdalena Bay, on the Norways (near 80° N.L.), and other places. These stone heaps form the palace of the rotge, richer in rooms and halls than any other in the wide round world. If one climbs up among the stones, he sees at intervals actual clouds of fowl suddenly emerge from the ground either to swarm round in the air or else to fly out to sea, and at the same time those that remain make their presence underground known by an unceasing cackling and din, resembling, according to Friedrich Martens, the noise of a crowd of quarrelling women. Should this sound be stilled for a few moments, one need only attempt in some opening among the stones to imitate their cry (according to Martens: *rott-tet-tet-tet-tet*) to get immediately eager and sustained replies from all sides. The fowl circling in the air soon settle again on the stones of the mountain slopes, where, squabbling and fighting, they pack themselves so close together that from fifteen to thirty of them may be killed by a single shot. A portion of the flock

now flies up again, others seek their safety like rats in concealment among the blocks of stone. But they soon creep out again, in order, as if by agreement, to fly out to sea and search for their food, which consists of crustacea and vermes. The rotge dives with ease. Its single blueish-white egg is laid on the bare ground without a nest, so deep down among the stones that it is only with difficulty that it can be got at. In the talus of the mountains north of Horn Sound I found on the 18th June, 1858, two eggs of this bird lying directly on the layer of ice between the stones. Probably the hatching season had not then begun. Where the main body of these flocks of birds passes the winter, is unknown,[1] but they return to the north early—sometimes too early. Thus in 1873 at the end of April I saw a large number of rotges frozen to death on the ice in the north part of Hinloopen Strait. When cooked the rotge tastes exceedingly well, and in consequence of the great development of the breast muscles it affords more food than could be expected from its small size.

THE LITTLE AUK, OR ROTGE.
Swedish, Alkekung. (*Mergulus Alle*, L.)

Along with the rotge we find among the ice far out at sea flocks of *alkor* (looms, or Brünnich's guillemots), and the nearer we come to the coast, the more do these increase in number, especially if the cliffs along the shore offer to this species of seafowl—the most common of the Polar lands—convenient hatching places. For this purpose are chosen the faces of cliffs which rise perpendicularly out of the sea, but yet by ledges and uneven

[1] It deserves to be investigated whether some little auks do not, like the Spitzbergen ptarmigan, pass the winter in their stone mounds, flying out to sea only at pretty long intervals in order to collect their food.

places afford room for the hatching fowl. On the guillemot-fells proper, eggs lie beside eggs in close rows from the crown of the cliff to near the sea level, and the whole fell is also closely covered with seafowl, which besides in flocks of thousands and thousands fly to and from the cliffs, filling the air with their exceedingly unpleasant scream. The eggs are laid, without trace of a nest, on the rock, which is either bare or only covered with

THE LOOM OR BRÜNNICH'S GUILLEMOT.
Swedish, Alka. (*Uria Brünnichii*, Sabine.)

old birds' dung, so closely packed together, that in 1858 from a ledge of small extent, which I reached by means of a rope from the top of the fell, I collected more than half a barrel-full of eggs. Each bird has but one very large egg, grey pricked with brown, of very variable size and form. After it has been sat upon for some time, it is covered with a thick layer of birds' dung, and in this way the hunters are accustomed to distinguish uneatable eggs from fresh.

If a shot be fired at a "loomery," the fowl fly away in thousands from their hatching places, without the number of those that are not frightened away being apparently diminished. The clumsy and short-winged birds, when they cast themselves out of their places, fall down at first a good way before they get "sufficient air" under their wings to be able to fly. Before this takes place, many plump down into the water, sometimes even into the boat which may be rowed along the foot of the fell.

An unceasing, unpleasant cackling noise indicates that a continual gossip goes on in the "loomery"; and that the unanimity there is not great, is proved by the passionate screams which are heard now and then. A bird squeezes forward in order to get a place on a ledge of rock already packed full, a couple of others quarrel about the ownership of an egg which has been laid on a corner of the rock only a few inches broad, and which now during the dispute is precipitated into the abyss. By the beginning of July most of the eggs are uneatable. I have seen the young of the size of a rotge accompany their mothers in the middle of August. The loom breeds on Walden Island and the north coast of North-East land, accordingly far north of 80°. I found the largest "loomeries" on Spitzbergen south of Lomme Bay in Hinloopen Strait, at the southern entrance to Van Meyen Bay in Bell Sound, and at Alkornet in Ice Fjord. In respect to the large number of fowl, however, only the first of these can compete with the south shore of Besimannaja Bay (72° 54′ N.L.) and with the part of Novaya Zemlya that lies immediately to the south of this bay. The eggs of the loom are palatable, and the flesh is excellent, though not quite free from the flavour of train oil. In any case it tastes much better than that of the eider.

Along with the rotge and the loom two nearly allied species of birds, *lunnefogeln*, the Arctic puffin (*Mormon*

arcticus, L.) and *tejsten* or *tobis-grisslan*, the black guillemot (*Uria grylle*, L.) are to be seen among the drift-ice. I do not know any puffin-fells on Spitzbergen. The bird appears to breed there only in small numbers, though it is still found on the most northerly part of the island. On Novaya Zemlya, too, it occurs rather sparingly. The black guillemot, on the other hand, is found everywhere, though never collected in large flocks, along the shores of Spitzbergen, and Novaya Zemlya,

THE ARCTIC PUFFIN.
Swedish. Lumnefogel. (Mormon Arcticus. L.)

THE BLACK GUILLEMOT.
Swedish, Tejst. (Uria Grylle, L.)

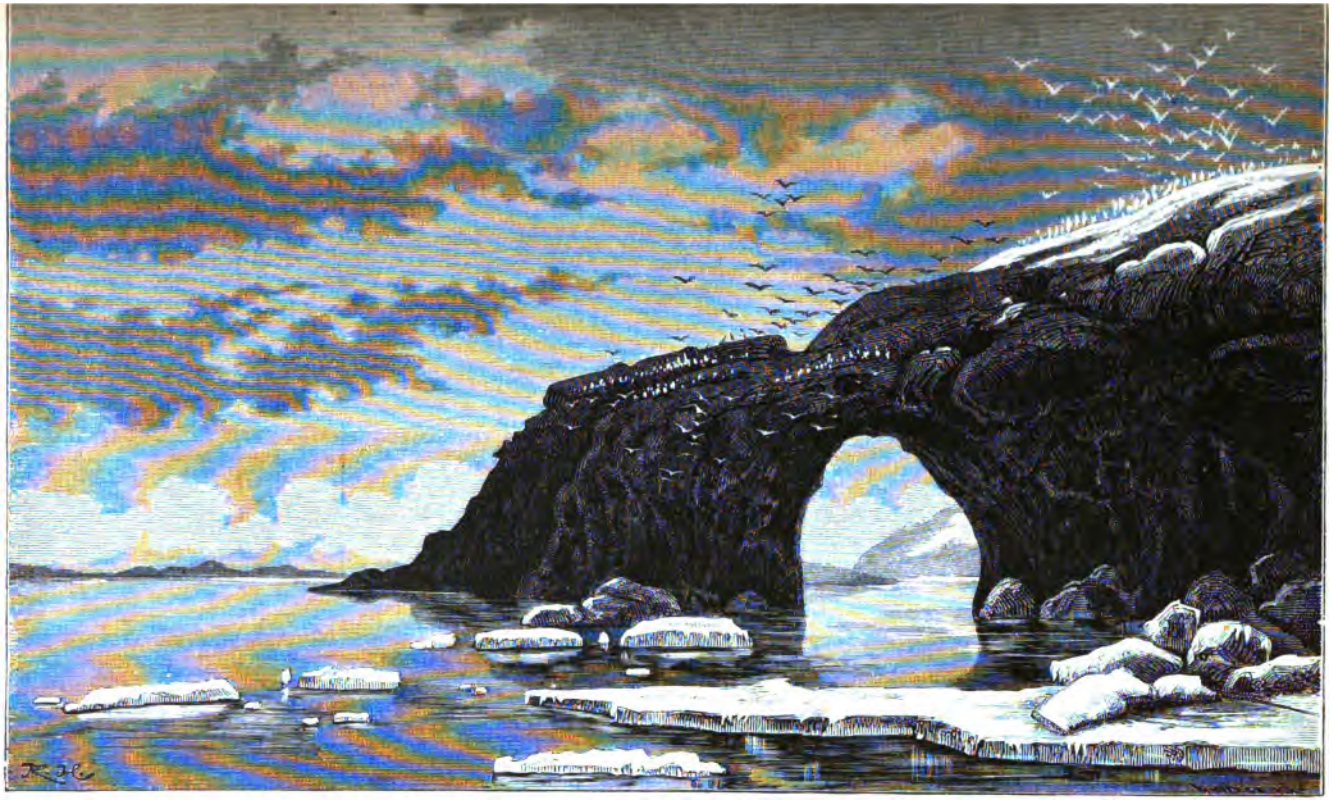
even as far north as Parry Island in 80° 40′ N.L., where in 1861 I saw several of their nests. These are placed near the summits of steep cliffs along the shore. The black guillemots often swim out together in pairs in the fjords. Their flesh has about the same taste as Brünnich's guillemot, but is tougher and of inferior quality; the eggs, on the other hand, are excellent.

The sea fowl mentioned above are never met with inland.

They never settle on a grassy sward or on a level sandy beach. The steep fowl-fell sides, the sea, ground-ice, pieces of drift-ice and small stones rising above the water, form their habitat. They swim with great skill both on, and under the water. The black guillemots and rotges fly swiftly and well; Brünnich's guillemots, on the contrary, heavily and ill. The latter therefore do not perhaps remove in winter farther from their hatching places than to the nearest open water, and it is probable that colonies of Brünnich's guillemots are not located at places where the sea freezes completely even far out from the coast. On this perhaps depends the scarcity of Brünnich's guillemot in the Kara Sea.

While sailing in the Arctic Ocean, vessels are nearly always attended by two kinds of gulls, the greedy *stormaosen* or *borgmaesteren*, glaucous gull (*Larus glaucus*, Brünn.), and the gracefully formed, swiftly flying *kryckian* or *tretaoiga maosen*, kittiwake (*Larus tridactylus*, L.), and if the hunter lies to at an ice-floe to flense upon it a seal which has been shot, it is not long till a large number of snow-white birds with dark blue bills and black legs settle down in the neighbourhood in order that they may get a portion of the spoil. They belong to the third kind of gull common in the north, *ismaosen*, the ivory gull (*Larus eburneus*, Gmel.).

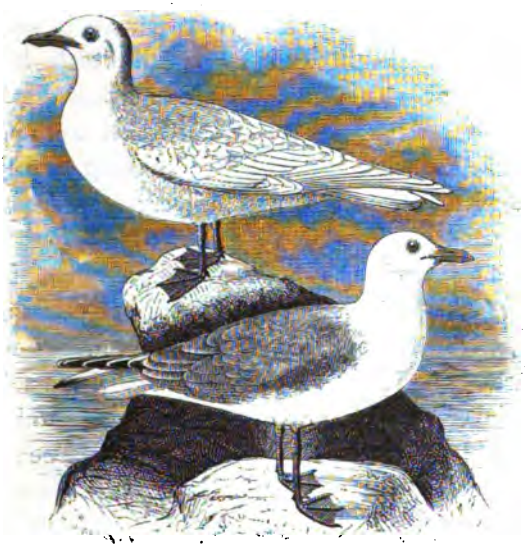
In disposition and mode of life these gulls differ much from each other. The glaucous gull is sufficiently strong to be able to defend its eggs and young against the attack of the mountain fox. It therefore breeds commonly on the summits of easily accessible small cliffs, hillocks or heaps of stones, preferably in the neighbourhood of "loomeries" or on fowl-islands, where the young of the neighbouring birds offer an opportunity for prey and hunting during the season when its own young are being fed. Sometimes, as for instance at Brandywine Bay on Spitzbergen, the glaucous gull breeds in great flocks on the ledges of steep fell-sides, right in the midst of Brünnich's



BREEDING-PLACE FOR GLAUCOUS GULLS.

Borgmaestareport on Bear Island, after a midnight photograph taken by the Author on the 18th—19th June, 1864.

guillemots. On Bear Island I have seen it hatch on the very beach, at a place, for instance, under the arch of a waterfall leaping down from a precipitous cliff. The nests, which, to judge from the quantity of birds' dung in their neighbourhood, are used for a long succession of years, are placed in a depression in the rock or the ground, and lined with a little straw or a



A. THE KITTIWAKE. Swedish, Kryckia. (Larus tridactylus, L.)

B. THE IVORY GULL. Swedish, Ismaos. (Larus eburneus, L.)

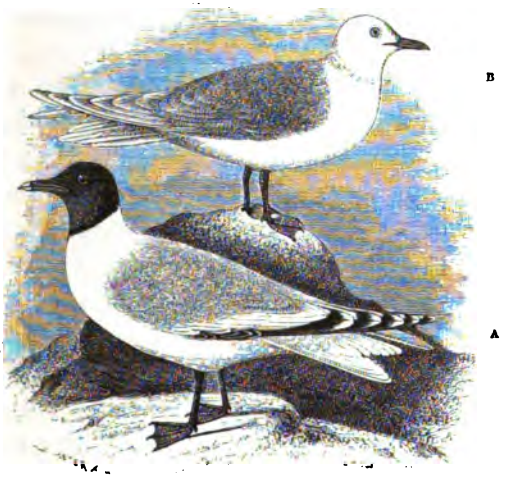
feather or two. The number of the eggs is three or four. After boiling they show a jellylike, half transparent white, and a reddish yellow, and are exceedingly delicious. The young birds have white flesh, resembling chicken. The burgomaster is common everywhere along the coasts of Novaya Zemlya and Spitzbergen. Yet I have not seen the nest of this gull on the north coast of North East Land or on the Seven Islands.

Still more common than the glaucous gull in the lands of the High North is *kryckian*, the kittiwake. It is met with far out at sea, where it accompanies the vessel whole days, circling round the tops of the masts, and sometimes—according to the statements of the walrus-hunters, when a storm is approaching—pecking at the points of the pendant. When the vessel is in harbour, the kittiwakes commonly gather round it to pick out anything eatable in the refuse that may be thrown away. They breed in great flocks on the steep escarpments in some separate part of the fowl-fells, in connection with which, it is evident that the kittiwakes always endeavour to choose the best places of the fell—those that are most inaccessible to the fox and are best protected against bad weather. Among the birds of the north the kittiwake is the best builder; for its nest is walled with straw and mud, and is very firm. It juts out like a great swallow's nest from the little ledge to which it is fixed. Projecting ends of straw are mostly bent in, so that the nest, with its regularly rounded form, has a very tidy appearance. The interior is further lined with a soft, carefully arranged layer of moss, grass and seaweed, on which the bird lays three to four well-flavoured eggs. The soft warm underlayer is, however, not without its inconvenience; for Dr. Stuxberg during the voyage of 1875 found in such a nest no fewer than twelve kinds of insects, among them *Pulex vagabundus*, Bohem. in nine specimens, a beetle, a fly, &c.

The ivory gull, called by Fr. Martens "Rathsherr," the Councillor, is found, as its Swedish name indicates, principally out at sea in the *pack*, or in fjords filled with drift-ice. It is a true ice-bird, and, it may almost be said, scarcely a water-bird at all, for it is seldom seen swimming on the surface, and it can dive as little as its relatives, the glaucous gull and the kittiwake. In greed it competes with the fulmar. When any large animal has been killed among the drift-ice, the ivory gull seldom fails to put in an appearance in order to quench its hunger with flesh

and blubber. It consumes at the same time the excrements of the seal and the walrus, on which account from three to five ivory gulls may often be seen sitting for a long time round a seal-hole, quiet and motionless, waiting patiently the arrival of the seal (Malmgren).

The proper breeding places of this bird scarcely appear to be yet known. So common as it is both on the coasts of Spitzbergen from the Seven Islands to South Cape and on the north



RARE NORTHERN GULLS.

A. Sabine's Gull. (Larus Sabinii, Sabine.) B. Ross's Gull. (Larus Rossii, Richards.)

coast of Novaya Zemlya and America, its nest has only been found twice, once in 1853 by McClintock at Cape Krabbe in North America in 77° 25′ N.L., the second time by Dr. Malmgren at Murchison Bay, in 82° 2′ N.L. The two nests that Malmgren found consisted of depressions, twenty-three to twenty-six centimetres in diameter, in a heap of loose gravel, on a ledge of a steeply-sloping limestone-rock wall. In each

nest was found only one egg, which, on the 30th July, already contained a down-covered young bird. For all the ivory gulls which have their home on Spitzbergen there were doubtless required several hundred such breeding-places as that at Murchison Bay. When to this is added the fact that we never in autumn saw on Spitzbergen any full-grown young of this kind of gull, I assume that its proper breeding-place must be found farther north, on the shores of some still unknown Polar land, perhaps continually surrounded by ice. It deserves to be mentioned with reference to this, that Murchison Bay was covered with ice when Malmgren found the nests referred to above.

Besides these varieties of the gull, two other species have been found, though very rarely, in the Polar regions, viz., *Larus Sabinii*, Sabine, and *Larus Rossii*, Richards. Although I have myself only seen the latter, and that but once (on the Chukchi Peninsula), I here give drawings of them both for the use of future Polar explorers. They are perhaps, if they be properly observed, not so rare as is commonly supposed.

Often during summer in the Arctic regions one hears a penetrating shriek in the air. When one inquires into the reason of this, it is found to proceed from a kittiwake, more rarely from a glaucous gull, eagerly pursued by a bird as large as a crow, dark-brown, with white breast and long tail-feathers. It is *labben*, the common skua (*Lestris parasitica*, L.), known by the Norwegian walrus-hunters under the name of *tjufjo*, derived from the bird's cry, "*I-o i-o*," and its shameless thief-nature. When the "tjufjo" sees a kittiwake or a glaucous gull fly off with a shrimp, a fish, or a piece of blubber, it instantly attacks it. It flies with great swiftness backwards and forwards around its victim, striking it with its bill, until the attacked bird either drops what it has caught, which is then immediately snapped up by the skua, or else settles down upon the surface of the water, where it is protected against attack. The skua

besides eats eggs of other birds, especially of eiders and geese. If the eggs are left but for a few moments unprotected in the nest, it is immediately to the front and shows itself so voracious that it is not afraid to attack nests from which the hatching

A. THE COMMON SKUA.
Swedish, Labben. (Lestris parasitica, L.)

B. BUFFON'S SKUA.
Swedish, Fjellabben. (Lestris Buffonii, Boie.)

C. THE POMARINE SKUA.
Swedish, Bredstjertade Labben. (Lestris pomarina, Tem.)

birds have been frightened away by men engaged in gathering eggs only a few yards off. With incredible dexterity it pecks a hole in the eggs and sucks their contents. If speed is necessary, this takes place so quickly and out of so many eggs

in succession that it sometimes has to stand without moving, unable to fly further until it has thrown up what it had swallowed. The skua in this way commonly takes part in the plundering of every eider island. The walrus-hunters are very much embittered against the bird on account of this intrusion on their industry, and kill it whenever they can. The whalers called it "struntjaeger"—refuse-hunter—because they believed that it hunted gulls in order to make them void their excrements which "struntjaegeren" was said to devour as a luxury.

The skua breeds upon low, unsheltered, often water-drenched headlands and islands, where it lays one or two eggs on the bare ground, often without trace of a nest. The eggs are so like the ground that it is only with difficulty that they can be found. The male remains in the neighbourhood of the nest during the hatching season. If a man, or an animal which the bird considers dangerous, approaches the eggs, the pair endeavour to draw attention from them by removing from the nest, creeping on the ground and flapping their wings in the most pitiful way. The bird thus acts with great skill a veritable comedy, but takes good care that it is not caught.

As is well known, we know only two varieties of colour in this bird, a self-coloured brown, and a brown on the upper part of the body with white below. Of these I have only once in the Arctic regions seen the self-coloured variety, viz. at Bell Sound in 1858. All the hundreds of skuas which I have seen, besides, have had the throat and lower part of the body coloured white.

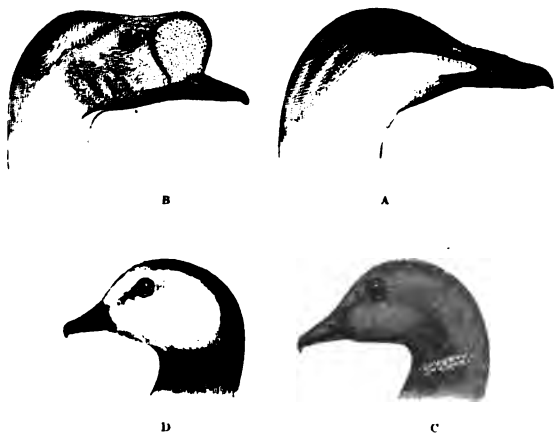
This bird is very common on Spitzbergen and Novaya Zemlya. Yet perhaps it scarcely breeds on the north part of North-East Land. Along with the bird now described there occur, though sparingly, two others:—*bredstjertade labben*, the Pomarine skua (*Lestris pomarina*, Tem.) and *fjellabben*, Buffon's skua (*Lestris Buffonii*, Boie). The latter is distinguished by its

more slender build and two very long tail-feathers, and it is much more common farther to the east than on Spitzbergen. I have not had an opportunity of making any observations on the mode of life of these birds.

As the skua pursues the kittiwake and the glaucous gull, it is in its turn pursued with extraordinary fierceness by the little swiftly-flying and daring bird *taernan*, the Arctic tern (*Sterna macroura*, Naum.). This beautiful bird is common everywhere on the coasts of Spitzbergen, but rather rare on Novaya Zemlya. It breeds in considerable flocks on low grass-free headlands or islands, covered with sand or pebbles. The eggs, which are laid on the bare ground without any trace of a nest, are so like lichen-covered pebbles in colour, that it is only with difficulty one can get eyes upon them; and this is the case in a yet higher degree with the newly-hatched young, which notwithstanding their thin dress of down have to lie without anything below them among the bare stones. From the shortness of their legs and the length of their wings it is only with difficulty that the tern can go on the ground. It is therefore impossible for it to protect its nest in the same way as the "tjufjo." Instead, this least of all the swimming birds of the Polar lands does not hesitate to attack any one, whoever he may be, that dares to approach its nest. The bird circles round the disturber of the peace with evident exasperation, and now and then goes whizzing past his head at such a furious rate that he must every moment fear that he will be wounded with its sharp beak.

Along with the swimmers enumerated above, we find everywhere along these shores two species of eider, the *vanliga eidern*, common eider (*Somateria mollissima*, L.) and *praktejdern*, king-duck (*Somateria spectabilis*, L.). The former prefers to breed on low islands, which, at the season for laying eggs, are already surrounded by open water and are thus rendered inaccessible to the mountain foxes that wander about on the mainland. The richest eider islands I have seen in Spitzbergen are the Down

Islands at Horn Sound. When I visited the place in 1858 the whole islands were so thickly covered with nests that it was necessary to proceed with great caution in order not to trample on eggs. Their number in every nest was five to six, sometimes larger, the latter case, according to the walrus-hunters, being accounted for by the female when she sits stealing eggs from her neighbours. I have myself seen an egg of *Anser bernicla* in an eider's nest. The eggs are hatched by the female, but the beautifully coloured male watches in her neighbourhood and



HEADS OF THE
A. EIDER; B. KING DUCK; C. BARNACLE GOOSE; D. WHITE-FRONTED GOOSE.

gives the signal of flight when danger approaches. The nest consists of a rich, soft, down bed. The best down is got by robbing the down-covered nest, an inferior kind by plucking the dead birds. When the female is driven from the nest she seeks in haste to scrape down over the eggs in order that they may not be visible. She besides squirts over them a very stinking fluid, whose disgusting smell adheres to the collected eggs and down. The stinking substance is however so volatile or so easily decomposed in the air that the smell completely

disappears in a few hours. The eider, which some years ago was very numerous on Spitzbergen,[1] has of late years considerably diminished in numbers, and perhaps will soon be completely driven thence, if some restraint be not laid on the heedless way in which not only the Eider Islands are now plundered, but the birds too killed, often for the mere pleasure of slaughter. On Novaya Zemlya, too, the eider is common. It breeds, for instance, in not inconsiderable numbers on the high islands in Karmakul Bay. The eider's flesh has, it is true, but a slight flavour of train oil, but it is coarse and far inferior to that of Brünnich's guillemot. In particular, the flesh of the female while hatching is almost uneatable.

The king-duck occurs more sparingly than the common eider. On Spitzbergen it is called the "Greenland eider," on Greenland the "Spitzbergen eider," which appears to indicate that in neither place is it quite at home. On Novaya Zemlya, on the other hand, it occurs in larger numbers. Only once have I seen the nest of this bird, namely, in 1873 on Axel's Islands in Bell Sound, where it bred in limited numbers together with the common eider. In the years 1858 and 1864, when I visited the same place, it did not breed there. Possibly its proper breeding place is on Novaya Zemlya at the inland lakes a little way from the coast. The walrus-hunters say that its eggs taste better than those of the common eider. They are somewhat smaller and have a darker green colour.

On the Down Islands hatches, along with the eiders, the long-necked *prutgaessen*, barnacle goose (*Anser bernicla*, L.) marked on the upper part of the body in black and brownish grey. It lays four to five white eggs in an artless nest without down, scattered here and there among the eiders' nests rich in

[1] The quantity of eider-down which was brought from the Polar lands to Tromsoe amounted in 1868 to 540, in 1869 to 963, in 1870 to 882, in 1871 to 630, and in 1872 to 306 kilograms. The total annual yield may be estimated at probably three times as much.

down. This variety of goose is found in greatest numbers during the moulting season at small inland lakes along the coast, for instance on the line of coast between Bell Sound and Ice Fjord and on Gooseland. The walrus-hunters sometimes call them "rapphoens" —partridges— a misleading name, which in 1873 induced me to land on the open coast south of Ice Fjord, where "rapphoens" were to be found in great numbers. On landing I found only moulting barnacle geese. The barnacle goose finds its food more on land and inland lakes than in the sea. Its flesh accordingly is free from the flavour of train oil and tastes well, except that of the female during the hatching season, when it is poor and tough. The eggs are better than the eider's.

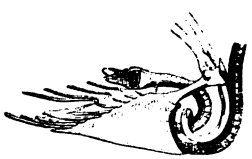
On Spitzbergen besides the barnacle goose we meet with the closely allied species *Anser leucopsis*, Bechst. It is rather rare, but more common on Novaya Zemlya. Further there occurs at the last-named place a third species of goose, *vildgaosen*, the "grey goose" or "great goose" of the walrus-hunters; the bean goose (*Anser segetum*, Gmel.), which is replaced on Spitzbergen by a nearly allied type, the pink-footed goose (*Anser brachyrhynchus*, Baillon). These geese are much larger than both the eider and the barnacle goose, and appear to be sufficiently strong to defend themselves against the fox. They commonly breed high up on some mossy or grassy oasis, among the stone mounds of the coast mountains, or on the summit of a steep strand escarpment in the interior of the fjords. During the moulting season the grey geese collect in flocks at the small fresh-water lakes along the coast. The flesh of this species of goose is finer than that of the common tame goose and has no trace of any train flavour.

Among the swimming birds that give the summer life on Novaya Zemlya its peculiar character, we may further reckon the scaup-duck and the swan. *Alfogel* or *allan*, the long-tailed duck (*Fuligula glacialis*, L.) is rare on Spitzbergen, but occurs

very generally on Novaya Zemlya, and especially in the Kara Sea, on whose coasts it is seen in summer collected in large flocks. *Mindre saongsvanen*, Bewick's swan (*Cygnus Bewickii*, Yarr.), is the most nobly formed and coloured bird of the

BEWICK'S SWAN.

Swedish, Mindre Saongsvanen. (Cygnus Bewickii, Yarr.)



BREASTBONE

of Cygnus Bewickii, showing the peculiar position of the windpipe. After Yarrell.

north. I have already described its nest, which is found in considerable numbers in Gooseland. The bird is blinding white, resembling the common swan, but somewhat smaller and with a considerable difference in the formation of the wind-

pipe and the "keel" of the breastbone. The flesh is said to be coarse and of inferior flavour.

The land-birds in the Arctic regions are less numerous both in species and individuals than the sea-birds. Some of them, however, also occur in large numbers. Almost wherever one lands, some small greyish brown waders are seen running quickly to and fro, sometimes in pairs, sometimes in flocks of ten to twenty. It is the most common wader of the north, the *fjaerplyt* of the walrus-hunters, the purple sandpiper (*Tringa maritima*, Brünn.). It lives on flies, gnats, and other land insects. Its well-filled crop shows how well the bird knows how to collect its food even in regions where the entomologist can only with difficulty get hold of a few of the animal forms belonging to his field of research. The purple sandpiper lays its four or five eggs in a pretty little nest of dry straw on open grassy or mossy plains a little distance from the sea. It also endeavours to protect its nest by acting a comedy like that of the *tjuffjo*. Its flesh is delicious.

In the company of the purple sandpiper there is often seen a somewhat larger wader, or, more correctly, a bird intermediate between the waders and the swimming birds. This is the beautiful *bredna-ebbade simsnaeppan*, the grey (or red) phalarope (*Phalaropus fulicarius*, Bonap.). It is not rare on Spitzbergen, and it is exceedingly common, perhaps even the commonest bird on the north coast of Asia. I imagine therefore that it is not absent from Novaya Zemlya, though there has hitherto been observed there only the nearly allied *smalnaebbade simsnaeppan*, the red-necked phalarope (*Phalaropus hyperboreus*, Lath.). This bird might be taken as the symbol of married love, so faithful are the male and female, being continually to be seen in each other's company. While they search for their food in pools of water along the coast, they nearly always bear each other company, swimming in zigzag, so that every now and then they brush past each other. If one of them is shot, the

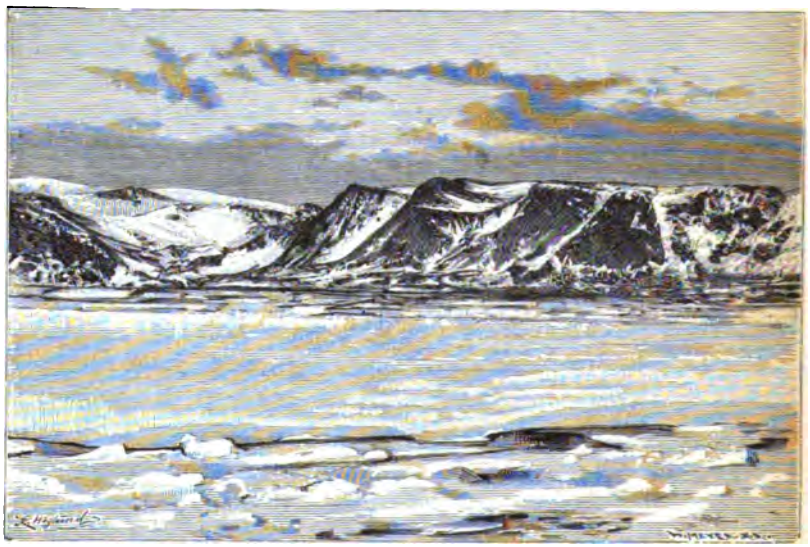
other flies away only for a short time until it observes that its mate is left behind. It then flies back, swims with evident distress round its dead friend, and pushes it with its bill to get it to rise. It does not, however, spend any special care on its nest or the rearing of its young, at least to judge by the nest which Dunér found at Bell Sound in 1864. The position of the nest was indicated by three eggs laid without anything below them on the bare ground, consisting of stone splinters. The flesh of the phalarope is a great delicacy, like that of other waders which occur in the regions in question, but which I cannot now stay to describe.

During excursions in the interior of the land along the coast, one often hears, near heaps of stones or shattered cliffs, a merry twitter. It comes from an old acquaintance from the home land, the *snoesparfven* or *snoelaerkan*, the snow-bunting (*Emberiza nivalis*, L.). The name is well chosen, for in winter this pretty bird lives as far south as the snow goes on the Scandinavian peninsula, and in summer betakes itself to the snow limit in Lapland, the *tundra* of North Siberia, or the coasts of Spitzbergen and Novaya Zemlya. It there builds its carefully-constructed nest of grass, feathers and down, deep in a stone heap, preferably surrounded by a grassy plain. The air resounds with the twitter of the little gay warbler, which makes the deeper impression because it is the only true bird's song one hears in the highest north.[1]

On Spitzbergen there is sometimes to be met with in the interior of the country, on the mountain slopes, a game bird, *spetsbergsripan*, the rock ptarmigan (*Lagopus hyperboreus*, Sund.). A nearly allied type occurs on the Taimur peninsula,

[1] There are, however, various other song-birds found already on south Novaya Zemlya, for instance, *lappsparfven*, the Lapland bunting (*Emberiza lapponica*, L.), and *berglaerkan*, the shore-lark (*Alauda alpestris*, L.). They hatch on the ground under bushes, tufts of grass, or stones, in very carefully constructed nests lined with cotton-grass and feathers, and are not uncommon.

and along the whole north coast of Asia. It perhaps therefore can scarcely be doubted that it is also to be found on Novaya Zemlya, though we have not hitherto seen it there. On Spitzbergen this bird had only been found before 1872 in single specimens, but in that year, to our glad surprise, we discovered an actual ptarmigan-fell in the neighbourhood of our winter colony, immediately south of the 80th degree of latitude. It



PTARMIGAN FELL

Mussel Bay on Spitzbergen, after a photograph taken by A. Envall on the 21st June, 1872.

formed the haunt of probably a thousand birds; at least a couple of hundred were shot there in the course of the winter. They probably breed there under stones in summer, and creeping in among the stones pass the winter there, at certain seasons doubtless in a kind of torpid state.

The mode of life of the Spitzbergen ptarmigan is thus widely different from that of the Scandinavian ptarmigan, and its flesh

also tastes differently. For the bird is exceedingly fat, and its flesh, as regards flavour, is intermediate between black-cock and fat goose.[1] We may infer from this that it is a great delicacy.

When I was returning, in the autumn of 1872, from an excursion of some length along the shore of Wijde Bay, I fell in with one of our sportsmen, who had in his hand a white bird

THE SNOWY OWL.
Swedish, Fjelluggla. (Strix nyctea, L.)

marked with black spots, which he showed me as a "very large ptarmigan." In doing so, however, he fell into a great ornithological mistake, for it was not a ptarmigan at all, but another kind of bird, similarly marked in winter, namely, *fjelluggla*n, the walrus-hunter's *isoern*, the snowy owl (*Strix nyctea*, L.). It evidently breeds and winters at the ptarmigan-fell, which it

[1] Hedenström also states (*Otrywki o Sibiri*, St. Petersburg, 1830, p. 130,) that the ptarmigan winters on the New Siberian Islands, and that there it is fatter and more savoury than on the mainland.

appears to consider as its own poultry-yard. In fact, the marking of this bird of prey is so similar to that of its victim that the latter can scarcely perhaps know how to take care of itself. On Spitzbergen the snowy owl is very rare; but on Novaya Zemlya and the North coast of Asia—where the lemming, which is wanting on Spitzbergen, occurs in great crowds—it is common. It commonly sits immoveable on an open mountain slope, visible at a great distance, from the strong contrast of its white colour with the greyish-green ground. Even in the brightest sunshine, unlike other owls, it sees exceedingly well. It is very shy, and therefore difficult to shoot. The snow ptarmigan and the snowy owl are the only birds of which we know with certainty that they winter on Spitzbergen, and both are, according to Hedenström, native to the New Siberian Islands (*Otrywki o Sibiri*, p. 112).

In the cultivated regions of Europe the larger mammalia are so rare that most men in their whole lifetime have never seen a wild mammal so large as a dog. This is not the case in the high north. The number of the larger mammalia here is indeed no longer so large as in the seventeenth century, when their capture yielded an abundant living to from twenty to thirty thousand men; but sport on Novaya Zemlya and Spitzbergen still supports several hundred hunters, and during summer scarcely a day passes without a visitor of the coasts of these islands seeing a seal or a walrus, a reindeer or a Polar bear. In order to present a true picture of the Polar traveller's surroundings and mode of life, it is absolutely necessary to give a sketch of the occurrence and mode of life of the wild mammalia in the Polar lands.

I shall make a beginning with the reindeer. This graminivorous animal goes nearly as far to the north as the land in the old world. It was not, indeed, observed by Payer on Franz Josef Land, but traces of the reindeer were seen by us on

the clay beds at Cape Chelyuskin; remnants of reindeer were observed at Barents' winter harbour on the northernmost part of Novaya Zemlya; some very fat animals were killed by Norwegian walrus-hunters on King Karl's Land east of Spitzbergen, and for some years back the reindeer was very numerous even on the north coast of North East Land, and on Castrén's, Parry's, Marten's, and Phipps' Islands, lying still farther to the north. Although these regions are situated between 80° and 81° N.L., the reindeer evidently thrives there very well, and finds, even in winter, abundant food on the mountain slopes swept clear of snow by storms, as is shown by the good condition in which several of the animals shot by us were, and by the numerous reindeer traces and tracks which we saw on Castrén's Island in the month of May, 1873. Nor does a winter temperature of $-40°$ to $-50°$ appear to agree particularly ill with these relatives of the deer of the south. Even the Norwegian reindeer can bear the climate of Spitzbergen, for some of the selected draught reindeer which I took with me to Spitzbergen in 1872, and which made their escape soon after they were landed, were shot by hunters in 1875. They then pastured in company with wild reindeer, and were, like them, very fat. It is remarkable that the reindeer, notwithstanding the devastating pursuit to which it is exposed on Spitzbergen,[1] is found there in much larger numbers than on North Novaya Zemlya or the Taimur peninsula, where it is almost protected from the attacks of the hunter. Even on the

[1] The hunters from Tromsoe brought home, in 1868, 996; in 1869, 975; and in 1870, 837 reindeer. When to this we add the great number of reindeer which are shot in spring and are not included in these calculations, and when we consider that the number of walrus-hunting vessels which are fitted out from Tromsoe is less than that of those which go out from Hammerfest, and that the shooting of reindeer on Spitzbergen is also carried on by hunters from other towns, and by tourists; we must suppose that at least 3,000 reindeer have been killed during each of those years. Formerly reindeer stalking was yet more productive, but since 1870 the number killed has considerably diminished.

low-lying part of South Novaya Zemlya, the reindeer, notwithstanding the abundance of the summer pasture, is so rare that, when one lands there, any reindeer-hunting is scarcely to be counted on. It first occurs in any considerable numbers farther to the north, on both sides of Matotschkin Schar.

It deserves to be mentioned here that three hundred years ago, when the north part of Novaya Zemlya was for the first time visited by man, reindeer do not appear to have been more numerous there than now. In the narrative of Barents' third voyage (De Veer, *Diarium Nauticum*, 21st June, 1596) it is expressly stated: "Here it may be remarked that, although the land, which we consider as Groenland (the present Spitzbergen), lies under and over the 80th degree of latitude, there grow there abundant leaves and grass, and there are found there such animals as eat grass, as *reindeer*, while on the other hand, on Novaya Zemlya, under the 76th degree of latitude, there are neither leaves nor grass nor any grass-eating animal." After this, however, traces of reins were found even at the winter station; a bear, for instance, was killed that had devoured a reindeer.

On Spitzbergen the reindeer have been considerably diminished in numbers by the hunting, first of the Dutch and English, and afterwards of the Russians and Norwegians. In the north-western part of the island, where the Dutch had their train-boiling establishments, the animal has been completely extirpated.[1]

[1] When Spitzbergen was first mapped, a great number of places were named after reindeer, which shows that the reindeer was found there in large numbers, and now just at these places it is completely absent. On the other hand, the Dutch and English explorers during the sixteenth century saw no reindeer on Novaya Zemlya. During the Swedish expedition of 1875 no reindeer were seen on the west coast of this island south of Karmakul Bay, while a number were shot at Besimannaja Bay and Matotschkin Schar. When some of the companions of the well-known walrus-hunting captain, Sievert Tobiesen, were compelled in 1872-73 to winter at North Goose Cape, they shot during winter and spring only eleven reindeer. Some Russians, who by an accident were obliged to pass six

It still, however, occurs on Ice Fjord in very great numbers, which, were the animal protected, would speedily increase.

That so devastating a pursuit as that which goes on year after year on Spitzbergen can be carried on without the animal being extirpated, has even given rise to the hypothesis of an immigration from Novaya Zemlya. But since I have become better acquainted with the occurrence of the reindeer in the latter place, this mode of explanation does not appear to me to be correct. If, therefore, as several circumstances in fact indicate, an immigration of reindeer to Spitzbergen does take place, it must be from some still unknown Polar land situated to the north-north-east. In the opinion of some of the walrus-hunters there are indications that this unknown land is inhabited, for it has repeatedly been stated that *marked* reindeer have been taken on Spitzbergen. The first statement on this point is to be found in Witsen (*Noort ooster gedeelte van Asia en Europa*, 1705, ii. page 904), where the reins are said to have been marked on the horns and the ears; and I have myself heard hunters, who in Norway were well acquainted with the care of reindeer, state positively that the ears of some of the Spitzbergen reindeer they shot were clipped—probably, however, the whole has originated from the ears having been marked by frost. That no immigration to Spitzbergen of reindeer from Novaya Zemlya takes place, is shown besides by the fact that the Spitzbergen reindeer appears to belong to a race differing from the Novaya Zemlya reindeer, and distinguished by its smaller size, shorter head and legs, and plumper and fatter body.

years in succession somewhere on the coast of Stans Foreland (Maloy Broun), and who, during this long time, were dependent for their food on what they could procure by hunting without the use of fire-arms (they had when they landed powder and ball for only twelve shots), when the three survivors were found and taken home in 1749, had killed two hundred and fifty reindeer (P. L. le Roy, *Relation des Aventures arrivées à quatre matelots Russes jettés par une tempête près de l'Isle deserte d'Ost-Spitzbergen, sur laquelle ils ont passé six ans et trois mois*, 1766).

The life of the wild reindeer is best known from Spitzbergen. During summer it betakes itself to the grassy plains in the ice-free valleys of the island, in late autumn it withdraws—according to the walrus-hunters' statements—to the sea-coast, in order to eat the seaweed that is thrown up on the beach, and in winter it goes back to the lichen-clad mountain heights in the

REINDEER PASTURE.
Green Harbour on Spitzbergen, after a photograph taken by A. Envall on the 20th July, 1873.

interior of the country, where it appears to thrive exceedingly well, though the cold during winter must be excessively severe; for when the reindeer in spring return to the coast they are still very fat, but some weeks afterwards, when the snow has frozen on the surface, and a crust of ice makes it difficult for them to get at the mountain sides, they become so poor as

scarcely to be eatable. In summer, however, they speedily eat themselves back into condition, and in autumn they are so fat that they would certainly take prizes at an exhibition of fat cattle. In the museum at Tromsoe there is preserved the backbone of a reindeer, shot on King Karl's Land, which had a layer of fat seven to eight centimetres in thickness on the loin.

The reindeer, in regions where it has been much hunted, is very shy, but, if the ground is not quite even, one can creep within range, if the precaution be taken not to approach it from the windward. During the rutting season, which falls in late autumn, it sometimes happens that the reindeer attacks the hunter.

The Spitzbergen reindeer is not tormented, like the reindeer in Lapland and on Novaya Zemlya, by "gorm" (inch-long larvæ of a fly, which are developed under the animal's skin). Its flesh is also better than that of the Lapp reindeer. None of the contagious diseases which of late years have raged so dreadfully among the reindeer in northern Europe has ever, at least during the last fifty years, been common on Spitzbergen.

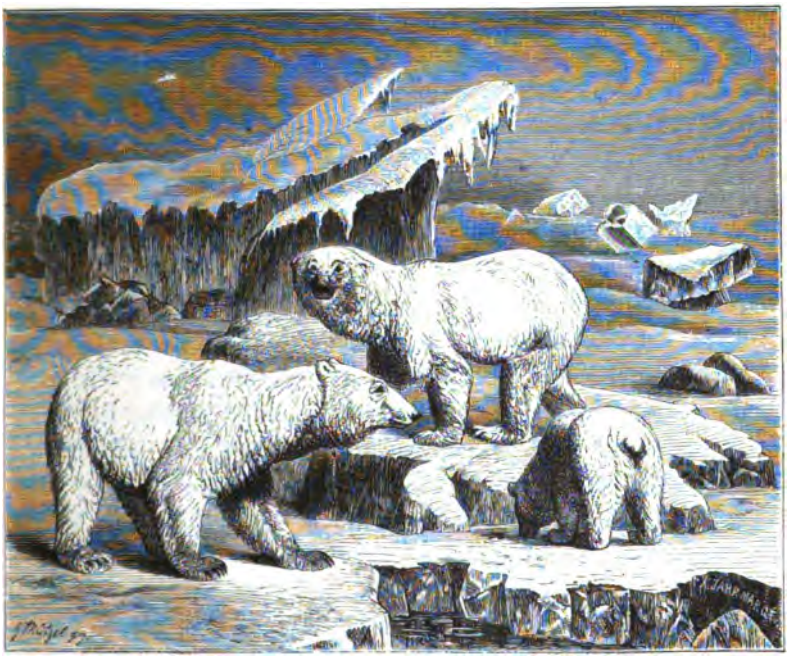
The Polar bear occurs principally on coasts and islands which are surrounded by drift-ice, often even upon ice-fields far out at sea, for his best hunting is among the ice-floes. Now he is rather rare on the south-western coasts of Spitzbergen and Novaya Zemlya which are almost free of ice during summer, but more common on the northern parts of these islands, which are almost always surrounded by ice. Thus for instance during my many landings at Horn Sound, Bell Sound, Ice Fjord, Foreland Sound, and King's Bay, on the west coast of Spitzbergen, I have never seen a single bear. On the other hand, bears were seen at nearly every resting-place during the boat voyage I made in 1861 with Torell in Hinloopen Strait and along the shores of the most northerly islands on Spitzbergen, also during the sledge journey which Palander and I made in the spring of 1873 round North East Land. The Polar bear is besides found

everywhere along the north coast of Asia and America, apparently in greater numbers the farther north we go. Sometimes too, first on ice and then swimming, he has reached the north coast of Norway, for instance, in March 1853, when, according to a statement in *Tromsoe Stiftstidende* (No. 4 for 1869), a Polar bear was killed in Kjoellefjord in East Finmark.

The bear is not difficult to kill. When he observes a man he commonly approaches in hope of prey, with supple movements, and in a hundred zigzag bends, in order to conceal the direction he intends to take, and thus keep his prey from being frightened. During his approach he often climbs up on blocks of ice, or raises himself on his hind legs, in order to get a more extensive view, or else stands snuffing up the air with evident care in all directions, in order, by the aid of smell, which he seems to rely upon more than sight, to ascertain the true kind and nature of the surrounding objects. If he thinks he has to do with a seal, he creeps or trails himself forward along the ice, and is said then to conceal with the fore-paws the only part of his body that contrasts with the white colour of the snow—his large black nose. If one keeps quite still, the bear comes in this way so near that one can shoot him at the distance of two gun-lengths, or, what the hunters consider safer, kill him with the lance. If an unarmed man falls in with a Polar bear, some rapid movements and loud cries are generally sufficient to put him to flight, but if the man himself flies, he is certain to have the bear after him at full speed. If the bear is wounded, he always takes to flight. He often lays snow upon the wound with his fore-paws ; sometimes in his death struggles he scrapes with his fore-feet a hole in the snow, in which he buries his head.

When a vessel lies at anchor, the bear sometimes swims out to it, and if one encamps in distant regions one often finds on getting up in the morning a Polar bear in the neighbourhood, who during the night has gone and nosed round the tent,

without daring to attack it. I remember only one case of a bear venturing to look into an inhabited tent; it was during Kane's journey. He was frightened on that occasion by the lighting of some lucifers. I have myself with my comrades encamped without a watch in regions where we were certain that our encampment would be visited, while we lay in deep



POLAR BEARS.
Drawn by G. Mützel of Berlin.

sleep, by some bear, that seldom, when the cook rose to make coffee, failed to come within range of shot.

The bear on the other hand has a special fancy for taking an inventory of depôts of provisions, of abandoned vessels, or of boats that have been left drawn up on the beach. Most Arctic travellers have remarkable adventures to relate, which both

men and bears have gone through on such occasions. During our expedition in 1864, for instance, a large bear came and closely examined the contents of a boat covered with a tent, which we had left unwatched for a few hours at the bottom of Stor Fjord. He ate up a carefully-cooked reindeer roast, tore the reserve clothes, scattered about the ship-biscuit, &c.; and after we had returned in the evening, gathered our things together in a heap, closed the tent and lain down to sleep, the same bear returned, and, while we slept, appropriated all the reindeer beef we had cooked to be used, in place of the roast we had lost, during the following day's journey. During one of the English expeditions in search of Franklin, there was killed on one occasion, a bear in whose stomach there was found, among many other articles, the stock of sticking-plaster from a neighbouring depôt. The bear can also swallow very large stones, but a layer of frozen sand is too much for him.

The Polar bear swims exceedingly well, but not so fast as that he can escape in this way, if he be pursued in a boat; if a boat and stout rowers are at hand he is accordingly done for, if, as often happens, he in attempting to escape seeks his deliverance in the sea. There, he is, as the hunters say, "as easy to kill as a sheep," but one has to make haste to get hold of the killed animal with a harpoon or in some other way, for it speedily sinks, unless it is very fat.

The walrus-hunting vessels from Tromsoe brought home in 1868 twenty, in 1869 fifty-three, in 1870 ninety-eight, in 1871 seventy-four, and in 1872 thirty-three bears. It may be inferred from this that the Norwegian walrus-hunters kill yearly on an average at least a hundred bears. It is remarkable that in this large number a pregnant female or one with newly-born young is never found.[1] The female bear appears to keep herself well

[1] During the wintering of 1869-70 on East Greenland, Dr. Pansch once saw a female bear with quite small young (*Die zweite deutsche Nordpolarfahrt*, Leipzig, 1873-74. Vol. II. p. 157).

concealed during the time she is pregnant; perhaps in some ice-hole in the interior of the country.

Whether the Polar bear hibernates during winter is not quite settled; various facts, however, point in this direction. For instance, he disappears almost completely from wintering stations during the dark time, and holes have sometimes been met with in which bears were concealed. Thus it once happened to Tobiesen that he went down with one foot into such a hole, to the no small dismay not only of the experienced walrus-hunter, but also of the bear.

It is also stated that the bear during the dark time goes to the edge of the ice to seek his food. I cannot say positively whether this is the case or not; but the fact points in an opposite direction, that while only a single bear was seen in the course of the winter in the open water in the neighbourhood of our winter station at Mussel Bay in 1872-73, Palander and I almost daily saw bears on the hard frozen sea north of North East Land. Tracks of bears were visible there in all directions on the ice, and along with them light, sinuous traces of the fox. There were, on the other hand, no seal holes to be found, and it was accordingly difficult to understand wherefore the bears had chosen just this desolate stretch of ice as their haunt. The bears that were killed were besides uncommonly lean, the fat which they yielded being scarcely available as fuel for the sledge-party's cooking apparatus.

During their extended excursions after prey the male and the female, the latter generally attended by one or two large young ones, keep each other company. Larger numbers are seldom seen together, unless at places where a good many carcases of walruses, seals, or white fish are lying.

In former times the sight of a bear created great dismay in Polar travellers, but now the walrus-hunters do not hesitate a moment to attack, lance in hand, a large number of bears. They have sometimes in this way killed as many as twelve

within a short time. They depend less on the gun. During the expedition of 1861 Carl Chydenius shot three in a few minutes, close to his tent-covered boat.

I do not know a single case in which any Norwegian walrus-hunter has been seriously wounded by a bear. It appears, however, as if this animal were bolder and more dangerous in regions where he has not made acquaintance with man's dangerous hunting implements. During the first English and Dutch voyages to Novaya Zemlya, bears were met with at nearly every place where a landing was effected, in regions where the Polar bear is now wholly absent, and the travellers were compelled to undertake actual combats—combats which cost several human lives. During Barents' second voyage some men on the $\frac{26\text{th}}{16\text{th}}$ September, 1595, landed on the mainland near the eastern mouth of Yugor Schar, in order to collect "a sort of diamonds occurring there" (valueless rock crystals), when a large white bear, according to De Veer, rushed forward and caught one of the stone collectors by the neck. On the man screaming "Who seizes me by the neck?" a comrade standing beside answered, "A bear," and ran off. The bear immediately bit asunder the head of his prey, and sucked the blood. The rest of the men who were on land now came to his relief, attacking the bear with levelled guns and lances. But the bear was not frightened, but rushed forward and laid hold of a man in the rank of the attacking party, and killed him too, whereupon all the rest took to flight. Assistance now came from the vessel, and the bear was surrounded by thirty men, but against their will, because they had to do with a "grim, undaunted, and greedy beast." Of these thirty men only three ventured to attack the bear, whom these "courageous" men finally killed, after a rather severe struggle.

A large number of occurrences of a similar nature, though commonly attended with fortunate results, are to be found recorded in most of the narratives of Arctic travel. Thus

a sailor was once carried off from a whaler caught in the ice in Davis' Straits, and in 1820, among the drift-ice in the sea between Greenland and Spitzbergen, the same fate was like to befall one of the crew of a Hull whaler; but he succeeded in effecting his escape by taking to flight, and throwing to the bear, first his only weapon of defence, a lance, and then his articles of clothing, one after the other.[1] On the 6th of March 1870, Dr. Boergen was attacked by a bear, and dragged a considerable distance.[2] It is remarkable that the bear did not this time either kill his prey, but that he had time to cry out, "A bear is dragging me away;" and that, after the bear had dragged him several hundred yards and he had got free, he could, though very badly scalped, himself make his way back to the vessel. The scalping had been done by the bear attempting to crush the skull in its mouth, as it is accustomed to do to the seals it catches. Scoresby considers it dangerous to hunt the Polar bear in deep snow. The well-known Dane, C. Petersen, guide to McClintock, Kane and others, on the other hand, considered it as little dangerous to attack a bear as to slaughter a sheep. The Siberian traveller, Hedenström, says that a man may venture to do so with a knife tied to a walking-stick, and the Norwegian hunters, or at least the Norwegian-Finnish harpooners, express themselves in much the same way regarding "this noble and dangerous" sport.

The bear's principal food consists of the seal and walrus. It is said that with a single stroke of his powerful paw he can cast a walrus up on the ice. On the other hand he seldom succeeds in catching the reindeer, because it is fleeter than the bear. I have, however, in North East Land, on two occasions, seen blood and hair of reindeer which had been caught by bears. There is not the least doubt that, along with flesh, the bear also

[1] W. Scoresby's des Jüngern, *Tagebuch einer Reise auf dem Wallfischfang. Aus dem engl. uebers.* Hamburg, 1825, p. 127.

[2] *Die zweite deutsche Nordpolarfahrt*, Vol. I. p. 465.

eats vegetable substances, as seaweed, grass, and lichens. I have several times, on examining the stomach of a bear that had been shot, found in it only remains of vegetable substances; and the walrus-hunters know this so well that they called a large old Polar bear, which Dr. Theel shot at Port Dickson in 1875, "an old Land-king" that was too fat to go a hunting, and therefore ate grass on land. He makes use besides of food of many different kinds; a bear, for instance, in the winter 1865-66 consumed for Tobiesen the contents of two barrels of salt fish, which he had left behind in a deserted hut.

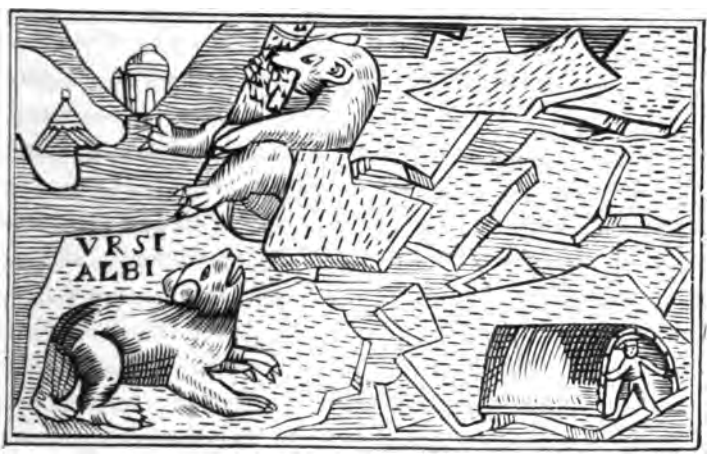
The flesh of the bear, if he is not too old or has not recently eaten rotten seal-flesh, is very eatable, being intermediate in taste between pork and beef. The flesh of the young bear is white and resembles veal. The eating of the liver causes sudden illness.

Although, as already mentioned, the Polar bear sometimes drifts to land and is killed in the northernmost part of Norway, his skin is not enumerated by Othere among the products of Finmark. It thus appears to have become known in Europe first after the Norwegians' discovery of Iceland and Greenland, and was at first considered an extraordinary rarity. A Norwegian of importance, who had emigrated to Iceland, and there succeeded in getting hold of a female bear with two young, sent them in 880 to the King of Norway, and got in return a small vessel laden with wood. This animal had not then been seen in Norway before. The old sagas of the north are said to relate further that the priest Isleif, in order to be nominated bishop of Iceland, in the year 1056 presented a white bear to Kejsar Henrik. In the year 1064 the King of Denmark gave in exchange for a white bear from Greenland a well-equipped, full rigged, trading vessel, a considerable sum of money, and a valuable gold ring.[1]

Marco Polo also says in his account of the country of the

[1] *Grönlands historiske Mindesmärker.* Kjöbenhavn, 1838, III. p. 384.

peace-loving nomad Tatar tribes living in the north, that there are to be found there white bears most of them twenty hands long, large black foxes, wild asses (reindeer), and a little animal called "rondes," from which we get the sable fur.[1] As the Polar bear is only to be found on the coast of the Arctic Ocean, these statements prove that in the thirteenth century the northernmost part of Asia was inhabited or at least visited by hunters. Olaus Magnus even describes the bear's mode of life not incorrectly,



POLAR BEARS.
After Olaus Magnus (1555).

with the addition that it was customary to present their skins to the altars of cathedrals and parish churches in order that the feet of the priest might not freeze during mass.[2] The Polar bear however first became more generally known in Western Europe by the Arctic voyages of the English and Dutch, and its price has now sunk so much that its skin, which was once considered an article of extraordinary value, is now, in adjusting

[1] Ramusio, Part II., Venice, 1583, p. 60.
[2] Ol. Magnus. Rome edition, 1555, p. 621.

accounts between the owners of a vessel and the walrus-hunters, reckoned at from twenty-five to fifty Scandinavian crowns (say twenty-eight to fifty-six shillings).

In 1609 Stephen Bennet, during his seventh voyage to Bear Island, captured two young Polar bears, which were brought to England and kept at Paris Garden (Purchas, iii. p. 562). Now such animals are very frequently brought to Norway in order to be sent from thence to the zoological gardens of Europe, in which the Polar bear is seldom wanting. The capture is facilitated by the circumstance that the young bears seldom leave their mother when she is killed.

Along with the reindeer and the bear there are found in the regions now in question only two other land-mammalia, the mountain fox (*Vulpes lagopus* L.) and the lemming (*Myodes obensis* Brants).[1] The fox is rather common both on Spitzbergen and Novaya Zemlya. Its abode sometimes consists of a number of passages excavated in the ground and connected together, with several openings. Such a nest I saw on Wahlberg's Island in Hinloopen Strait on the summit of a fowl-fell; it was abundantly provided with a stock of half-rotten guillemots, concealed in the passages. The old foxes were not visible while we were there, but several young ones, some black, some variegated red and white, ran hither and thither from out the openings and played with supple movements in the neighbourhood of the nest. A similar nest also, with young that ran between its openings, played and hunted each other, I have seen on the north shore of Matotschkin Schar, and uninhabited fox-holes and passages at several places on the west coast of Novaya Zemlya, commonly in the tops of dry sandy knolls.

The lemming is not found on Spitzbergen, but must at

[1] It is stated that wolves also occur on Novaya Zemlya as far up as to Matotschkin Sound. They are exceedingly common on the north coasts of Asia and Eastern Europe.

certain seasons occur in incredible numbers on Novaya Zemlya. For at the commencement of summer, when the snow has recently melted away, there are to be seen, everywhere in the level fertile places in the very close grass of the meadows, foot-paths about an inch and a half deep, which have been formed during winter by the trampling of these small animals, under the snow, in the bed of grass or lichens which lies immediately above the frozen ground They have in this way united with each other the dwellings they had excavated in the ground, and constructed for themselves convenient ways, well protected against the severe cold of winter, to their fodder-places. Thousands and thousands of animals must be required in order to carry out this work even over a small area, and wonderfully keen must their sense of locality be, if, as seems probable, they can find their way with certainty in the endless labyrinth they have thus formed. During the snow-melting season these passages form channels for running off the water, small indeed, but everywhere to be met with, and contributing in a considerable degree to the drying of the ground. The ground besides is at certain places so thickly strewed with lemming dung, that it must have a considerable influence on the condition of the soil.

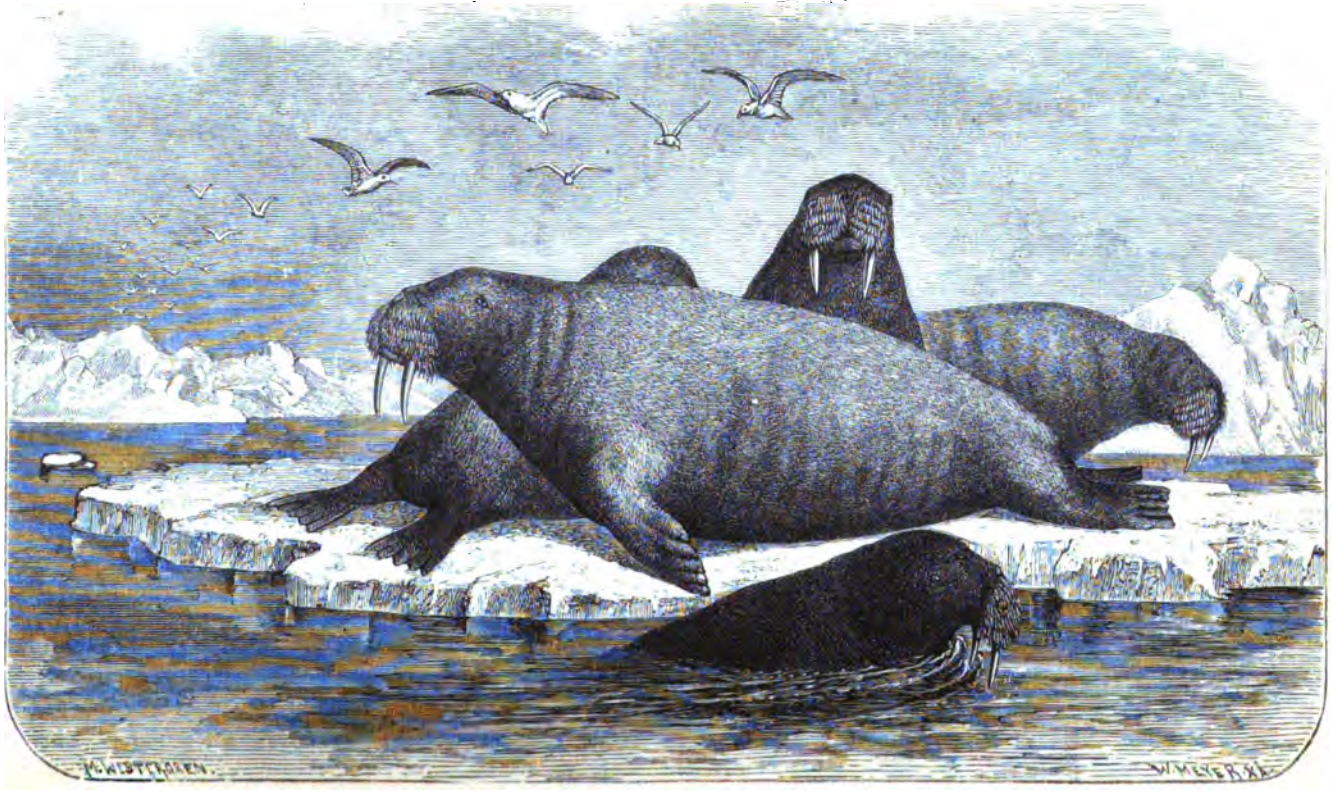
In the Arctic regions proper one is not tormented by the mosquito,[1] and viewed as a whole the insect fauna of the entire Polar area is exceedingly scanty, although richer than was before supposed. Arachnids, acarids, and podurids occur most

[1] That is to say, not on Spitzbergen and Novaya Zemlya, for it is otherwise on the coast of the mainland. In West Greenland the mosquito as far north as the southern part of Disco Island is still so terrible, especially to the new comer during the first days, that the face of any one who without a veil ventures into marshy ground overgrown with bushes, becomes in a few hours unrecognisable. The eyelids are closed with swelling and changed into water-filled bladders, suppurating tumours are formed in the head under the hair, &c. But when a man has once undergone this unpleasant and painful inoculation, the body appears, at least for one summer, to be less susceptible to the mosquito-poison.

plentifully, Dr. Stuxberg having been able during the Yenisej expedition of 1875 to collect a very large number of them, which were worked out after his return — the podurids by Dr. T. TULLBERG of Upsala, the arachnids by Dr. T. KOCH of Nürnberg. These small animals are found in very numerous individual specimens, among mouldering vegetable remains, under stones and pieces of wood on the beach, creeping about on grass, straws, &c.

Of the insects proper there were brought home from Novaya Zemlya, during the same expedition, nine species of coleoptera, which were determined by Professor F. W. MÄKLIN, of Helsingfors.[1] Some few hemiptera and lepidoptera and orthoptera, and a large number of hymenoptera and diptera from the same expedition have been examined by Lector A. E. HOLMGREN of Stockholm. Dr. Stuxberg also collected a large number of land-worms, which have been described by our countryman Dr. G. EISEN, now settled in California. The occurrence of this animal group in a region where the ground at the depth of a few inches is continually frozen, appears to me exceedingly remarkable—and from a general point of view the occurrence of insects in a land which is exposed to a winter cold below the freezing-point of mercury, and where the animal cannot seek protection from it by creeping down to a stratum of earth which never freezes, presupposes that either the insect itself, its egg, larva, or pupa, may be frozen stiff without being killed. Only

[1] As the *only* Chrysomela, which von Baer found at Matotschkin Schar, played so great a *rôle* in Arctic-zoological literature, I shall here enumerate the species of coleoptera, now known—after Professor Mäklin's determination of the collections which we brought home with us—to exist on Novaya Zemlya. These are:—*Feronia borealis* Ménétr., *F. gelida* Mäkl., *Amara alpina* Fabr., *Agabus sulquadratus* Motsch., *Homalota sibirica* Mäkl., *Homalium angustatum* Mäkl., *Cylletron* (?) *hyperboreum* Mäkl., *Chrysomela septentrionalis* (?) Ménétr., *Prasocuris hannoverana* Fabr., v. *degenerata*. From Vaygats Island we brought home seven species more, which were not found on Novaya Zemlya. The insects occur partly under stones, especially at places where lemming dung is abundant, or in tracts where birds'-nests are numerous, partly in warm days on willow-bushes.



WALRUSES.

very few species of these small animals, however, appear to survive such a freezing test, and the actual land-evertebrate-fauna of the Polar countries is therefore exceedingly scanty in comparison with that of more southerly regions.

It is quite otherwise as regards the sea. Here animal life is exceedingly abundant as far as man has succeeded in making his way to the farthest north. At nearly every sweep the dredge brings up from the sea-bottom masses of decapods, crustacea, mussels, asterids, echini,[1] &c., in varying forms, and the surface of the sea on a sunny day swarms with pteropods, beroids, surface-crustacea, &c. Dr. Stuxberg will give, farther on, a sketch of this department of animal life, which in the high north is so rich in variety. In the meantime I can but refer to the large number of papers on this subject which have been issued in the publications of the Swedish Academy of Sciences.

Of the higher animal types a greater number within the Polar territory occur in the sea than on the land. Thus by far the greater number of the birds I have enumerated above belong to the sea, not to the land, and this is the case with nearly all the animals which for three or four hundred years back have been the objects of capture in the Arctic regions. This industry, which during the whale-fishing period yielded a return perhaps equal to that of the American oil-wells in our time, has not now in the most limited degree the importance it formerly had. For the animal whose capture yielded this rich return, the right whale (*Balæna mysticetus* L.), is now so extirpated in these navigable waters, that the whalers were long ago compelled to seek new fishing-places in other parts of the Polar seas. It is therefore no longer the whale, but other species of animals which attract the hunter to the coasts of Spitzbergen and Novaya Zemlya.

Of these animals the most important for the last fifty years

[1] Echini occur only very sparingly in the Kara Sea and the Siberian Polar Sea, but west of Novaya Zemlya at certain places in such numbers that they almost appear to cover the sea-bottom.

has been the walrus, but it too is in course of being extirpated. It is now seldom found during summer on the west coast of Novaya Zemlya south of Matotschkin Schar. During our visits to that island in 1875, 1876, and 1878 we did not see one of these animals. But in the Kara Gate, on the east coast of Novaya Zemlya, and at certain places in the Kara Sea, abundant hunting is still to be had. Earlier in the year the walrus is also to be met with among the drift-ice on the west coast, and to the south, off the mouth of the Petchora, although the number of the animals that are captured by the Samoyeds at Chabarova appears to be exceedingly small. On the other hand the Dutch, in their first voyages hither, saw a considerable number of these gregarious animals. The walrus, however, did not then occur here in such abundance as they did at the same time on Spitzbergen and Bear Island, which evidently formed their principal haunts.

During Stephen Bennet's third voyage to Bear Island in 1606, 700 to 800 walruses were killed there in six hours, and in 1608 nearly 1,000 in seven hours. The carcases left lying on the beach attracted bears thither in such numbers that, for instance, in 1609 nearly fifty of them were killed by the crew of a single vessel. At one place eighteen bears were seen at once (Purchas, iii. p. 560). A Norwegian skipper was still able during a wintering in 1824-25 to kill 677 walruses. But when Tobiesen wintered there in 1865-66 he killed only a single walrus, and on the two occasions of my landing there I did not see one. Formerly the hunters almost every year, during late autumn when the drift-ice had disappeared, found "walrus on land," *i.e.* herds of several hundred walruses which had crept up on some low, even, sandy beach, to pass days and weeks there in an almost motionless state. During this period of rest most of them appear to be sunk in deep sleep, yet not all, for—according to the concurrent statements of all the walrus-hunters with whom I have conversed on this subject—they keep a watch to

warn their comrades when danger is near. If necessary precautions are observed, *i.e.* if the hunters approach the beach where the animals are assembled when the wind blows from the land, and kill with the lance those that lie nearest the water, the rest are slaughtered without difficulty, being prevented by the carcases of their dead comrades from reaching the sea. Now such an opportunity for the hunter happens exceedingly seldom; there are famous headlands on which in former times the walrus was found by hundreds, in whose neighbourhood now not a single one is to be seen.

In the sea too there are certain places which the walrus principally haunts, and which are therefore known by the hunters as walrus-banks. Such a bank is to be found in the neighbourhood of Muffin Island, situated on the north coast of Spitzbergen in 80° north latitude, and the animals that have been killed here must be reckoned by thousands. Another bank of the same kind is to be met with in 72° 15′ north latitude, on the coast of Yalmal. The reason why the walruses delight to haunt these places is doubtless that they find there abundant food, which does not consist, as has often been stated, of seaweed, but of various living mussels from the bottom of the sea, principally *Mya truncata* and *Saxicava rugosa*. Their fleshy parts are freed, before they are swallowed, so remarkably well from the shells, and cleaned so thoroughly, that the contents of the stomach have the appearance of a dish of carefully-shelled oysters. In collecting its food the walrus probably uses its long tusks to dig up the mussels and worms which are deeply concealed in the clay.[1] Scoresby states that in the stomach of a walrus he found, along with small crabs, pieces of a young seal.

[1] Compare Malmgren's instructive papers in the publications of the Royal (Swedish) Academy of Sciences and Scoresby's *Arctic Regions*, Edinburgh, 1820, i., p. 502. That the walrus eats mussels is already indicated in the Dutch drawing from the beginning of the seventeenth century reproduced below, page 160.

The largest walrus tusks I have seen were two of a male walrus purchased in the summer of 1879 at St. Lawrence Island, in the north part of Behring's Sea. They measured 830 and 825 millimetres in length, their largest circumference was 227 and 230 millimetres, and they weighed together 6,680 gram. I have seen the tusks of females of nearly the same length, but they are distinguished from those of the male by being much more slender. The surface of the tusks is always full of cracks, but under it there is a layer of ivory free of cracks, which again incloses a grained kernel of bone which at some places is semi-transparent, as if drenched with oil.

When the walrus ox gets very old, he swims about by himself as a solitary individual, but otherwise animals of the same age and sex keep together in large herds. The young walrus long follows its mother, and is protected by her with evident fondness and very conspicuous maternal affection. Her first care, when she is pursued, is accordingly to save her young even at the sacrifice of her own life. A female walrus with young is nearly always lost, if they be discovered from a hunting boat. However eagerly she may try by blows and cuffs to get her young under water or lead her pursuers astray by diving with it under her forepaw, she is generally overtaken and killed. Such a hunt is truly grim, but the walrus-hunter knows no mercy in following his occupation. The walrus, especially the old solitary male, sleeps and rests during autumn, when the drift-ice has disappeared, also in the water, with his head now above the surface, now under it, and with his lungs so strongly inflated that the body is kept floating, with part of the back projecting out of the water. The latter way of sleeping is indeed possible only for so long at once as the animal can keep below, but this is said to be a very long time. If a hunting boat meets a walrus sleeping in this way it is first wakened with a loud "strike up" before it is harpooned, "in order that in its fright it may not knock a hole in the boat with its tusks."

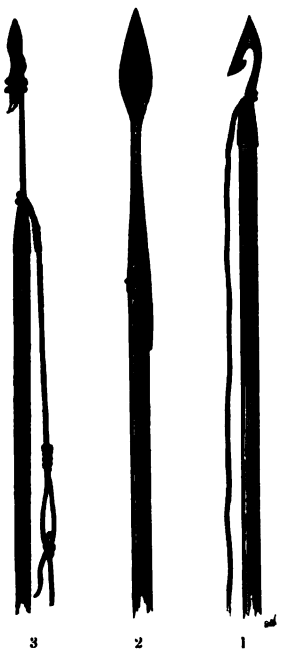
The walrus sinks and is lost, if he is killed by a shot while in the water, or if he be shot while lying on a piece of ice, but without being killed so instantaneously that he cannot cast himself into the water in his death struggles. He is killed accordingly almost exclusively with the harpoon or lance.

WALRUS TUSKS.

A. Tusk of male, outside. B. Tusk of male, inside. C. Tusks of female.
One-tenth of natural size.

The harpoon consists of a large and strong iron hook, very sharp on the outer edge, and provided with a barb. The hook is loosely fixed to the shaft, but securely fastened to the end of a slender line ten fathoms long, generally made of walrus hide. The line is fastened at its other end to the boat, in the forepart of which it lies in a carefully arranged coil. There are from five

to ten such harpoon lines in every hunting boat. When the hunters see a herd of walrus, either on a piece of drift-ice or in the water, they endeavour silently and against the wind to approach sufficiently near to one of the animals to be able to harpoon it. If this is managed, the walrus first dives and then endeavours to swim under water all he can. But he is fixed with the line to the boat, and must draw it along with him. His comrades swim towards the boat, curious to ascertain the cause of the alarm. A new walrus is fixed with another harpoon, and so it goes on, one after another, until all the harpoons are in use. The boat is now drawn forward at a whizzing speed, although the rowers hold back with the oars; but there is no actual danger as long as all the animals draw in the same direction. If one of them seeks to take a different course from that of his comrades in misfortune, his line must be cut off, otherwise the boat capsizes. When the walruses get exhausted by their exertions and by loss of blood, the hunters begin to haul in the lines. One animal after the other is drawn to the stem of the boat, and there they commonly first get a blow on the head with the flat of a lance, and when they turn to guard against it, a lance is thrust into the heart. Since breechloaders have begun to be used by the wa'rus-hunters, they often prefer to kill the harpooned walruses with a ball instead of "lancing" them. To shoot an unharpooned walrus, on the other hand, the walrus



HUNTING IMPLEMENTS.

(1) Harpoon, and (2) Lance for Walrus-hunting. (3) "Skottel" for the capture of the White Whale.

One-fifteenth of natural size.

hunters formerly considered an unpardonable piece of thoughtlessness, because the animal was in this way generally wounded or killed without any advantage accruing. They therefore expressed themselves with great irritation against the tourists who sometimes came to Spitzbergen, and in this way destroyed the hunting. It cannot however be denied that they themselves in recent times have often followed the bad example, and many consider that this is one of the main reasons of the great diminution in the numbers of the walrus of late years. Should an international code be established for hunting in the Polar sea, all shooting of unharpooned walruses ought to be forbidden in the first place.

Gregariousness and curiosity appear to be the main characteristics of the walrus. These qualities of theirs I had an opportunity of observing when once, on a glorious northern summer day, I rowed forward over a mirror-bright, drift-ice-bestrewn sea right into the midst of a considerable herd of these animals. Part followed the boat long distances quite peaceably, now and then emitting a grunting sound; others swam quite close, and raised themselves high out of the water in order to take a view of the foreigners; others, again, lay so closely packed on pieces of drift-ice as to sink them down to the water's edge, while their comrades swimming about in the sea endeavoured with violence to gain a place on the already overfilled resting-places, though a number of unoccupied pieces of ice floated up and down in the neighbourhood.

When the hunters have killed a female walrus, it often happens that they take the young living. It is easily tamed, and soon regards its keeper with warm attachment. It seeks, as best it can—poorly equipped as it is for moving about on dry land—to follow the seamen on the deck, and gives itself no rest if it be left alone. Unfortunately, one does not succeed in keeping them long alive, probably because it is impossible to provide them with suitable food. There are

instances, however, of the young of the walrus being brought to Europe alive. Thus it is said (Purchas, iii., p. 560), that Master Welden and Stephen Bennet, on the $\frac{22\text{nd}}{12\text{th}}$ July, 1608, caught two young walruses alive, one a male and the other a female. The female died before they reached England, but the male lived ten weeks. He was carried to court, shown to the king and many honourable gentlemen, and excited general admiration for his extraordinary form and great docility. A young walrus that was taken to St. Petersburg in 1829-30, also died in a short time. It gave occasion to K. E. von BAER'S famous treatise: "Anatomische und zoologische Untersuchungen über das Wallross," printed in *Mémoires de l'Académie Impériale des Sciences de St. Petersbourg*, ser. vi., t. iv. 2, 1838, p. 97.

The walrus is hunted for its skin, blubber, and oil. The value of a full-grown walrus was calculated at Tromsoe, in 1868, in settling accounts between the owners of hunting sloops and the hunters, at eighty Scandinavian crowns (say 4*l.* 10*s.*), but it sank in 1871 to only forty-eight crowns (say 2*l.* 15*s.*). The flesh of the walrus is coarse and train-flavoured, and is eaten by the hunters only in cases of necessity. From my own experience, however, I can certify that its comparatively small tongue is very delicious. By the Eskimo and the Chukchis the flesh of the walrus is considered a delicacy.

The walrus was doubtless hunted by the Polar tribes long before the historic period,[1] but it is mentioned for the first time in writing in the sketch of Othere's Arctic journey. The narrative shows that it was then captured on the north coast of Scandinavia. This appears the less improbable, as a walrus now and then even in our days drifts to land on the Norwegian coast, and walruses are still annually killed off Swjatoinos on the Kola peninsula.[2] The walrus is very correctly described in the

[1] Implements of walrus-bone occur among the Northern grave *finds*.

[2] Compare note at page 48 above.

well-known Norse confession written in the end of the eleventh century, "Konungs skuggsjá" (the King's Mirror), as an animal resembling the seal,[1] except that, besides several smaller teeth, it has two large tusks which project beyond the upper jaw. This clear and unexaggerated sketch is however replaced in the later writings of the middle ages by the most extraordinary accounts of the animal's appearance and mode of capture. Thus Albertus Magnus,[2] who died in 1280, says that the walrus is taken by the

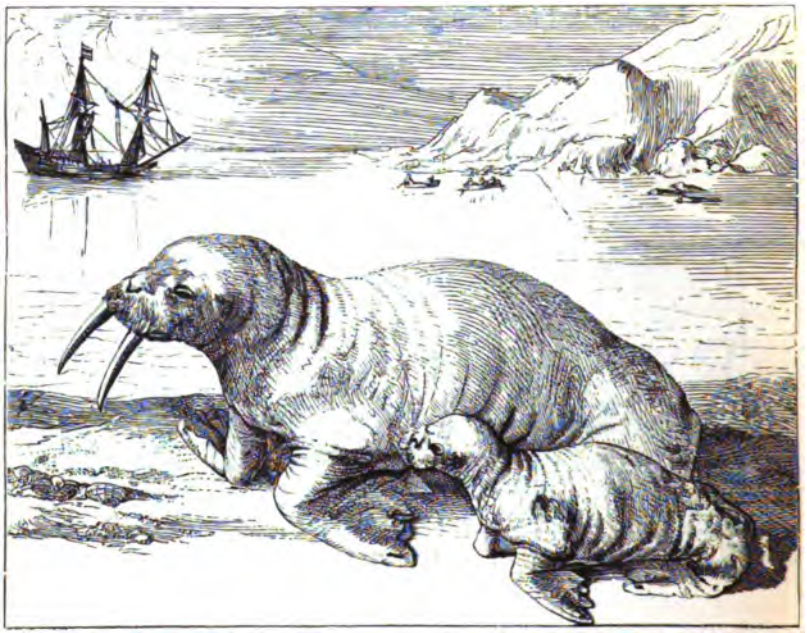
WALRUS HUNTING.
After Olaus Magnus (1555).

hunter, while the sleeping animal hangs by its large tusks to a cleft of the rock, cutting out a piece of its skin and fastening to it a strong rope whose other end is tied to trees, posts, or large

[1] I saw in 1858 a *Phoca barbata* with tusks worn away by age, which in its reddish-brown colour very much resembled a walrus, and was little inferior to it in size.

[2] Albertus Magnus, *De animalibus*, Mantua, 1479, Lib. xxiv. At the same place however is given a description of the whale-fishery grounded on actual experience, but with the shrewd addition that what the old authors had written on the subject did not correspond with experience.

rings fixed to rocks. The walrus is then wakened by throwing large stones at its head. In its attempts to escape it leaves its hide behind. It perishes soon after, or is thrown up half dead on the beach. He further states that walrus lines on account of their strength are suitable for lifting great weights, and that they are always on sale at Cologne. They were probably used at the



WALRUSES (female with young).
Old Dutch drawing.[1]

building of the Cathedral there. Similar extraordinary representations of the appearance and mode of life of the walrus are

[1] This drawing is made after a facsimile by Frederick Müller from Hessel Gerritz, *Descriptio et delineatio geographica detectionis freti*, &c. Amsterodami, 1613. The same drawing is reproduced coloured in Blavii *Atlas major*, Part I., 1665, p. 25, with the inscription: "Ad vivum delineatum ab Hesselo G.A."

JAPANESE DRAWING OF THE WALRUS.[1]

[1] The drawing is taken from a Japanese manuscript book of travels—No. 360 of the Japanese library which I brought home. According to a communication by an attaché of the Japanese embassy which visited Stockholm in the autumn of 1880, the book is entitled *Kau-kai-i-fun*, "Narrative of a remarkable voyage on distant seas." The manuscript, in four volumes, was written in 1830. In the introduction it is stated that when some Japanese, on the 21st November, 1793 (?), were proceeding with a cargo of rice to Yesso, they were thrown out of their course by a storm, and were driven far away on the sea, till in the beginning of the following June they came to some of the Aleutian islands, which had recently been taken by the Russians. They remained there ten months, and next year in the end of June they came to Ochotsk. The following year in autumn they were carried to Irkutsk, where they remained eight years, well treated by the Russians. They were then taken to St. Petersburg, where they had an audience of the Czar, and got furs and splendid food. Finally they were sent back by sea round Cape Horn to Japan in one of Captain von Krusenstern's vessels. They were handed over to the Japanese authorities in the spring of 1805, after having been absent from their native country about thirteen years. From Nagasaki they were carried to Yeddo, where they were subjected to an examination. One person put questions, another wrote the answers, and a third showed by drawings all the remarkable events they had survived. They were then sent to their native place. In the introduction it is further said that the shipwrecked were unskilful seamen, by whom little attention was often given to the most important matters. A warning accordingly is given against full reliance on their accounts and the drawings in the book. The latter occupy the fourth part of the work, consisting of more than 100 quarto pages. It is remarkable that the first Russian circumnavigation of the globe, and the first journey of the Japanese round the world, happened at the same time.

repeated in a more or less altered form even by Olaus Magnus, whose representation of the walrus is shown by the accompanying woodcut.

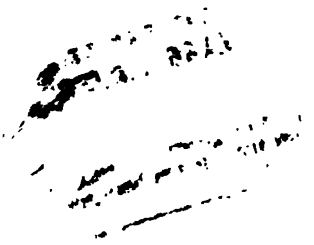
The $\frac{11\text{th}}{1\text{st}}$ of August 1556, the year after the publication of the work of Olaus Magnus, a West European saw for the first time some actual walruses, which had been killed by Russian hunters at Vaygats Island. No description of the animal, however, is given, but from that period all the members of the English and Dutch north-east expeditions had opportunities of seeing walruses in hundreds and thousands. It was now first that man learned actually to know this remarkable animal which had been decked out in so many fables. To this period belongs the beautiful and natural delineation of the walrus which is given above.

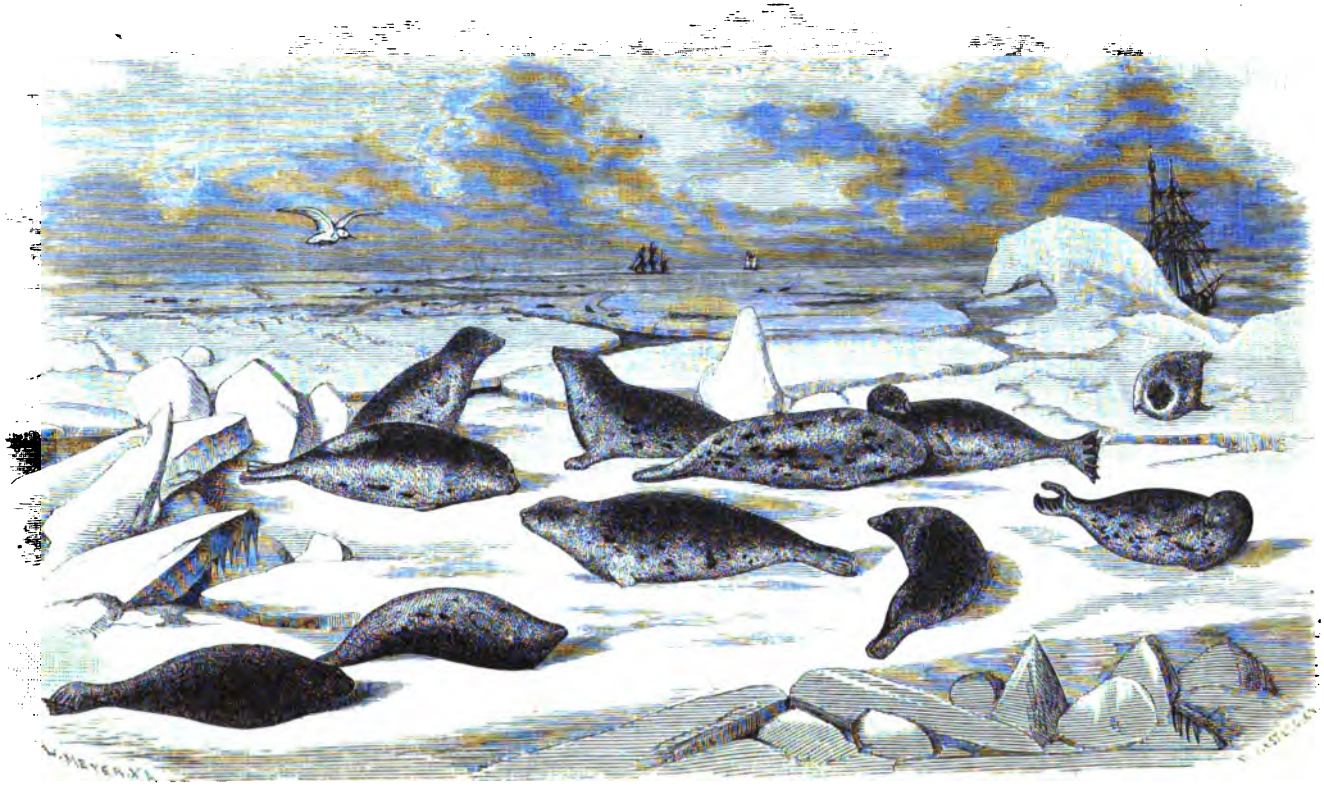
A peculiarity of the walrus may be mentioned here. The hide, especially in old males, is often full of wounds and scratches, which appear to be caused partly by combats and scraping against sharp pieces of ice, partly by some severe disease of the skin. Mr. H. W. Elliot has remarked this of the walrus in Behring's Sea.[1] The walrus is also troubled with lice, which is not the case, so far as I know, with any kind of seal. Masses of intestinal worms are found instead in the stomach of the seal, while on the contrary none are found in that of the walrus.

With reference to the other animals that are hunted in the Polar Sea I am compelled to be very brief, as I have scarcely any observations to make regarding them which are not already sufficiently known by numerous writings.

There are three kinds of seals on Novaya Zemlya. *Storsaelen*, the bearded seal (*Phoca barbata*, Fabr.) occurs pretty generally even on the coasts of Spitzbergen, though never in large flocks. The pursuit of this animal is the most important part of the

[1] *A Report upon the Condition of Affairs in the Territory of Alaska.* Washington, 1875, p. 160.





YOUNG OF THE GREENLAND SEAL.
After a drawing by A. W. Quennerstedt (1864).

seal-fishing in these waters, and the bearded seal is still killed yearly by thousands. Their value is reckoned in settling accounts between owners and hunters at twenty to twenty-five Scandinavian crowns (say 22*s.* to 27*s.* 6*d.*).

Groenlands or *Jan-Mayen-saelen*, the Greenland seal (*Phoca Groenlandica* Müller), which at Jan Mayen gives occasion to so profitable a fishing, also is of general occurrence among the drift-ice in the Murman and Kara seas.

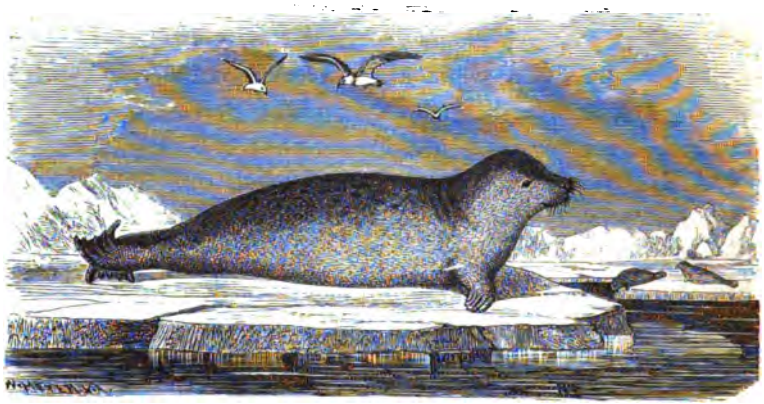
Snadden, the rough or bristled seal (*Phoca hispida*, Erxl.) is also common on the coast. These animals in particular are seen to lie, each at its hole, on the ice of fjords, which has not been broken up. It also many times follows with curiosity in the wake of a vessel for long distances, and can then be easily shot, because it is often so fat that, unlike the two other kinds of seals, it does not sink when it has been shot dead in the water.

Klapmytsen, the bladdernose seal, (*Cystophora cristata*, Erxl.) the walrus-hunters say they have never seen on Novaya Zemlya, but it is stated to occur yearly in pretty large numbers among the ice W.S.W. of South Cape on Spitzbergen. Only once during our many voyages in the Polar Sea has a *Klapmyts* been seen, viz, a young one that was killed in 1858 in the neighbourhood of Bear Island.

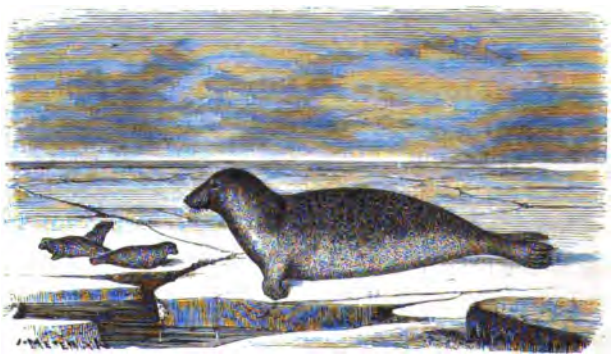
Of the various species of whales, the narwhal, distinguished by its long and valuable horn projecting in the longitudinal direction of the body from the upper jaw, now occurs so seldom on the coast of Novaya Zemlya that it has never been seen there by the Norwegian walrus-hunters. It is more common at Hope Island, and Witsen states (p. 903) that large herds of narwhals have been seen between Spitzbergen and Novaya Zemlya.

The white whale or beluga, of equal size with the narwhal, on the other hand, occurs in large shoals on the coasts of Spitzbergen and Novaya Zemlya, especially near the mouths of fresh-water streams. These animals were formerly captured, but

not with any great success, by means of a peculiar sort of harpoon, called by the hunters "skottel." Now they are caught



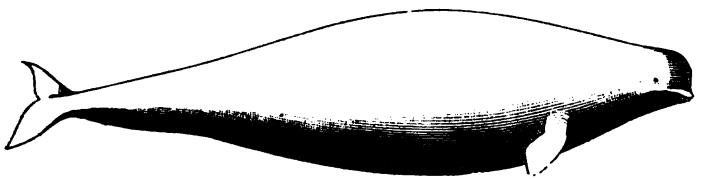
THE BEARDED SEAL.
Swedish, Storsäl. (*Phoca barbata*, Fabr.)



THE ROUGH SEAL.
Swedish, Snadd. (*Phoca hispida*, Erxl.)

with nets of extraordinary size and strength, which are laid out from the shore at places which the white whales are wont to frequent. In this way there were taken in the year 1871, when

the fishing appears to have been most productive, by vessels belonging to Tromsoe alone, 2,167 white whales. Their value was estimated at fifty-four Scandinavian crowns each (about 3*l.*). The fishing, though tempting, is yet very uncertain ; it sometimes falls out extraordinarily abundant, as in the spring of 1880, when a skipper immediately on arriving at Magdalena Bay caught 300 of these animals at a cast of the net. Of the whales thus killed not only the blubber and hide are taken away, but also, when possible, the carcases, which, when cheap freight can be had, are utilised at the guano manufactories in the north of Norway. After having lain a whole year on the beach at Spitzbergen they may be taken on board a vessel without any



THE WHITE WHALE. (*Delphinapterus leucas*, Pallas.)
After a drawing by A. W. Quennerstedt (1864).

great inconvenience, a proof that putrefaction proceeds with extreme slowness in the Polar regions.

With its blinding milk-white hide, on which it is seldom possible to discover a spot, wrinkle, or scratch, the full-grown white whale is an animal of extraordinary beauty. The young whales are not white, but very light greyish brown. The white whale is taken in nets not only by the Norwegians at Spitzbergen, but also by the Russians and Samoyeds at Chabarova. In former times they appear to have been also caught at the mouth of the Yenisej, to judge by the large number of vertebræ that are found at the now deserted settlements there. The white whale there goes several hundred kilometres up the river. I

have also seen large shoals of this small species of whale on the north coast of Spitzbergen and the Taimur peninsula.

Other species of the whale occur seldom on Novaya Zemlya. Thus on this occasion only two small whales were seen during our passage from Tromsoe, and I do not remember having seen more than one in the sea round Novaya Zemlya in the course of my two previous voyages to the Yenisej. At the north part of the island, too, these animals occur so seldom, that a hunter told me, as something remarkable, that towards the end of July, 1873, W.N.W. of the western entrance to Matotschkin Schar 20′ to 30′ from land, he had seen a large number of whales, belonging to two species, of which one was a *slaethval*, and the other had as it were a top, instead of a fin, on the back.

It is very remarkable that whales still occur in great abundance on the Norwegian coast, though they have been hunted there for a thousand years back, but, on the other hand, if we except the little white whale, only occasionally east of the White Sea. The whale fishing which was carried on on so grand a scale on the west coast of Spitzbergen, has therefore never been prosecuted to any great extent on Novaya Zemlya; and fragments of skeletons of the whale which are found thrown up in such quantities on the shores of Spitzbergen, are not to be found, so far as my experience reaches, either on the shores of Novaya Zemlya, on the coast of the Kara Sea, or at the places on the north coast of Siberia between the Yenisej and the Lena, at which we landed. The sacrifices which were so long made in vain in the endeavour to find a passage to China in this direction accordingly were not compensated, as on Spitzbergen, by the rise of a profitable whale fishery. Meeting with a whale is spoken of by the first seafarers in these regions as something very remarkable and dangerous; for instance, in the account of Stephen Burrough's voyage in 1556:—"On St. James his day, there was a monstrous whale aboord of us, so neere to our side that we might have thrust a sworde or any other weapon in

him, which we durst not doe for feare he should have overthrowen our shippe; and then I called my company together, and all of us shouted, and with the crie that we made he departed from us; there was as much above water of his back as the bredth of our pinnesse, and at his falling down he made such a terrible noise in the water, that a man would greatly have marvelled, except he had known the cause of it; but, God be thanked, we were quietly delivered of him." [1] When Nearchus sailed with the fleet of Alexander the Great from the Indus to the Red Sea, a whale also caused so great a panic that it was only with difficulty that the commander could restore order among the frightened seamen, and get the rowers to row to the place where the whale spouted water and caused a commotion in the sea like that of a whirlwind. All the men now shouted, struck the water with their oars, and sounded their trumpets, so that the large, and, in the judgment of the Macedonian heroes, terrible animal, was frightened. It seems to me that from these incidents we may draw the conclusion that great whales in Alexander's time were exceedingly rare in the sea which surrounds Greece, and in Burrough's time in that which washes the shores of England. Quite otherwise was the whale regarded on Spitzbergen some few years after Burrough's voyage by the Dutch and English whalers. At the sight of a whale all men were out of themselves with joy, and rushed down into the boats in order from them to attack and kill the valuable animal. The fishery was carried on with such success, that, as has already been stated, the right whale (*Balæna mysticetus* L.), whose pursuit then gave full employment to ships by hundreds, and to men by tens of thousands, is now practically extirpated. Thus during our many voyages in these waters we have only seen one such whale, which happened on the 23rd June, 1864, among the drift-ice off the west coast of Spitzbergen in 78° N.L. As the right whale still occurs in no limited numbers in other parts of

[1] Hakluyt, first edition, p. 317.

the Polar Sea, and as there has been no whale fishing on the coast of Spitzbergen for the last forty or fifty years, this state of things shows how difficult it is to get an animal type to return to a region where it has once been extirpated, or from which it has been driven away.

The whale which Captain Svend Foeyn has almost exclusively hunted on the coast of Finmark since 1864 belongs to quite another species, *blaohvalen* (*Balænoptera Sibbaldii* Gray); and there are likewise other species of the whale which still in pretty large numbers follow shoals of fish to the Norwegian coast, where they sometimes strand and are killed in considerable numbers. A *tandhval*, killer or sword-fish (*Orca gladiator* Desm.) was even captured some years ago in the harbour of Tromsoe. This whale was already dying of suffocation, caused by an attempt to swallow an eider which entered the gullet, not, as the proper way is, with the head, but with the tail foremost. When the mouthful should have slidden down, it was prevented by the stiff feathers sticking out, and the bird stuck in the whale's throat, which, to judge by the extraordinary struggles it immediately began to make, must have caused it great inconvenience, which was increased still more when the inhabitants did not neglect to take advantage of its helpless condition to harpoon it.

CHAPTER IV.

The Origin of the names Yugor Schar and Kara Sea—Rules for Sailing through Yugor Schar—The "Highest Mountain" on Earth—Anchorages—Entering the Kara Sea—Its Surroundings—The Inland-ice of Novaya Zemlya—True Icebergs rare in certain parts of the Polar Sea—The Natural Conditions of the Kara Sea—Animals, Plants, Bog Ore—Passage across the Kara Sea—The Influence of the Ice on the Sea-bottom—Fresh-water Diatoms on Sea-ice—Arrival at Port Dickson—Animal Life there—Settlers and Settlements at the Mouth of the Yenisej—The Flora at Port Dickson—Evertebrates—Excursion to White Island—Yalmal—Previous Visits—Nummelin's Wintering on the Briochov Islands.

In crossing to Vaygats Island I met the *Lena*, which then first steamed to the rendezvous that had been fixed upon. I gave the captain orders to anchor without delay, to coal from the *Express*, and to be prepared immediately after my return from the excursion to weigh anchor and start along with the other vessels. I came on board the *Vega* on the evening of the 31st July, much pleased and gratified with what I had seen and collected in the course of my excursion on Vaygats Island. The *Lena*, however, was not quite ready, and so the start was put off till the morning of the 1st August. All the vessels then weighed anchor, and sailed or steamed through Vaygats Sound or Yugor Schar into the Kara Sea.

We do not meet with the name Yugor Schar in the oldest narratives of travel or on the oldest maps. But it is found in an account dating from 1611, of a Russian commercial route

between "Pechorskoie Zauorot and Mongozei," which is annexed to the letter of Richard Finch to Sir Thomas Smith, already quoted (Purchas, iii. p. 539). The name is clearly derived from the old name, Jugaria, for the land lying south of the sound, and it is said, for instance, in the map to Herberstein's work, to have its name from the Hungarians, who are supposed to derive their origin from these regions. The first Dutch north-east explorers called it Vaygats Sound or Fretum Nassovicum. More recent geographers call it also Pet's Strait, which is incorrect, as Pet did not sail through it.

There was at first no special name for the gulf between the Taimur peninsula and Novaya Zemlya. The name "Carska Bay" however is to be found already in the information about sailing to the north-east, communicated to the Muscovie Companie by its principal factor, Antonie Marsh (Purchas, iii. p. 805). At first this name was applied only to the estuary of the Kara river, but it was gradually transferred to the whole of the neighbouring sea, whose oldest Samoyed name, also derived from a river, was in a somewhat Russianised form, "Neremskoe" (compare Purchas, iii. p. 805, Witsen, p. 917). I shall in the following part of this work comprehend under the name "Kara Sea" the whole of that gulf which from 77° N.L. between Cape Chelyuskin and the northern extremity of Novaya Zemlya extends towards the south to the north coast of Europe and Asia.

Captain Palander gives the following directions for sailing through the sound between Vaygats Island and the mainland:—

"As Yugor Straits are difficult to discover far out at sea, good solar observations ought to be taken on approaching them, where such can be had, and after these the course is to be shaped in the middle of the strait, preferably about N.E. by the compass. On coming nearer land (three to four English miles) one distinguishes the straits with ease. Afterwards there is nothing else to observe than on entering to keep right in the middle of the fairway.

"If one wishes to anchor at the Samoyed village one ought to keep about an English mile from the land on the starboard, and steer N.E. by the compass, until the Samoyed huts are seen, when one bends off from starboard, keeping the church a little to starboard. For larger vessels it is not advisable to go in shallower water than eight to nine fathoms, because the depth then diminishes rather suddenly to from three to four fathoms.

"From the Samoyed village the course is shaped right to the south-east headland of Vaygats Island (Suchoi Nos), which ought to be passed at the distance of half an English mile. Immediately south-west of this headland lies a very long shoal, which one ought to take care of.

"From this headland the vessel is to be steered N.$\frac{1}{2}$E. out into the Kara Sea. With this course there are two shoals on starboard and two on port at the distance of half an English mile.

"The depth is in general ten fathoms; at no place in the fairway is it less than nine fathoms.

"Vessels of the greatest draught may thus sail through Yugor Schar. In passing the straits it is recommended to keep a good outlook from the top, whence in clear weather the shoals may easily be seen."

In the oldest narratives very high mountains, covered with ice and snow, are spoken of as occurring in the neighbourhood of the sound between Vaygats Island and the mainland. It is even said that here were to be found the highest mountains on earth, whose tops were said to raise themselves to a height of a hundred German miles.[1] The honour of having the highest mountains on earth has since been ascribed by the dwellers on the plains of Northern Russia to the neighbourhood of Matotschkin Schar, "where the mountains are even much higher than Bolschoj Kamen," a rocky eminence some hundreds of feet high at the mouth of the Petchora—an orographic idea which forms a new proof of the correctness of the old saying:—"In the kingdom of the blind the one-eyed is king." Matotschkin Schar indeed is surrounded by a wild Alpine tract with peaks that

[1] *Les moeurs et usages des Ostiackes*, par Jean Bernard Muller, Capitaine de dragon au service de la Suède, pendant sa captivité en Sibérie (*Recueil de Voiages au Nord*. T. VIII., Amsterdam, 1727, p. 389).

rise to a height of 1,000 to 1,200 metres. On the other hand there are to be seen around Yugor Straits only low level plains, terminating towards the sea with a steep escarpment. These plains are early free of snow, and are covered with a rich turf, which yields good pasture to the Samoyed reindeer herds.

Most of the vessels that wish to sail into the Kara Sea through Yugor Schar require to anchor here some days to wait for favourable winds and state of the ice. There are no good harbours in the neighbourhood of the sound, but available anchorages occur, some in the bay at Chabarova, at the western entrance of the sound; some, according to the old Dutch maps, on the eastern side of the sound, between Mestni Island (Staten Eiland) and the mainland. I have, however, no experience of my own of the latter anchorages, nor have I heard that the Norwegian walrus-hunters have anchored there. Perhaps by this time they are become too shallow.

When we sailed through Yugor Schar in 1878, the sound was completely free of ice. The weather was glorious, but the wind was so light that the sails did little service. In consequence of this we did not go very rapidly forward, especially as I wished to keep the three vessels together, and the sailing ship *Express*, not to be left behind, had to be towed by the *Fraser*. Time was lost besides in dredging and taking specimens of water. The dredgings gave at some places, for instance off Chabarova, a rich yield, especially of isopods and sponges. The samples of water showed that already at a limited depth from the surface it had a considerable salinity, and that therefore no notable portion of the mass of fresh water, which the rivers Kara, Obi, Tas, and Yenisej and others pour into the Kara Sea, flows through this sound into the Atlantic Ocean.

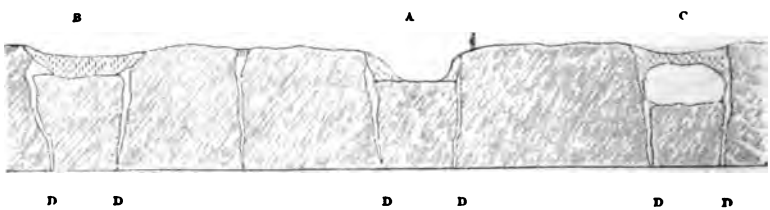
In the afternoon of the 1st August we passed through the sound and steamed into the sea lying to the east of it, which had been the object of so many speculations, expectations, and conclusions of so many cautious governments, merchants eager

for gain, and learned cosmographers, from the sixteenth and seventeenth centuries, and which even to the geographer and man of science of the present has been a *mare incognitum* down to the most recent date. It is just this sea that formed the turning-point of all the foregoing north-east voyages, from Burrough's to Wood's and Vlamingh's, and it may therefore not be out of place here, before I proceed further with the sketch of our journey, to give some account of its surroundings and hydrography.

If attention be not fixed on the little new-discovered island, "Ensamheten," the Kara Sea is open to the north-east. It is bounded on the west by Novaya Zemlya and Vaygats Island; on the east by the Taimur peninsula, the land between the Pjaesina and the Yenisej and Yalmal; and on the south by the northernmost portion of European Russia, Beli Ostrov, and the large estuaries of the Obi and the Yenisej. The coast between Cape Chelyuskin and the Yenisej consists of low rocky heights, formed of crystalline schists, gneiss, and eruptive rocks, from the Yenisej to beyond the most southerly part of the Kara Sea, of the Gyda and Yalmal *tundras* beds of sand of equal fineness, and at Vaygats Island and the southern part of Novaya Zemlya (to 73° N.L.) of limestone and beds of schist[1] which slope towards the sea with a steep escarpment three to fifteen metres high, but form, besides, the substratum of a level plain, full of small collections of water which is quite free of snow in summer. North of 73° again the west coast of the Kara Sea is occupied by mountains, which near Matotschkin are very high, and distributed in a confused mass of isolated peaks, but farther north become lower and take the form of a plateau.

[1] I come to this conclusion from the appearance of the strata as seen from the sea, and from their nature on Vaygats Island and the west coast of Novaya Zemlya. So far as I know, no geologist has landed on this part of the east coast.

Where the mountains begin, some few or only very inconsiderable collections of ice are to be seen, and the very mountain tops are in summer free of snow. Farther north glaciers commence, which increase towards the north in number and size, till they finally form a continuous inland-ice which, like those of Greenland and Spitzbergen, with its enormous ice-sheet, levels mountains and valleys, and converts the interior of the land into a wilderness of ice, and forms one of the fields for the formation of icebergs or glacier-iceblocks, which play so great a *rôle* in sketches of voyages in the Polar seas. I have not myself visited the inland-ice on the northern part of Novaya Zemlya, but doubtless the experience I have previously gained



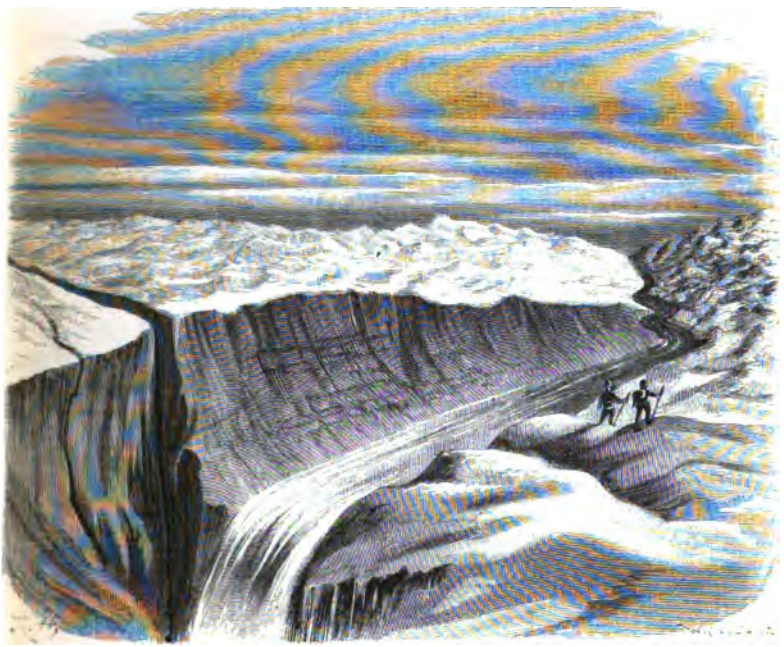
SECTION OF INLAND-ICE.

A. Open glacier-canal. B. Snow-filled canal. C. Canal concealed by a snow-vault. D. Glacier-clefts.

during an excursion with Dr. Berggren on the inland-ice of Greenland in the month of July 1870, *after all the snow on it had melted*, and with Captain Palander on the inland-ice of North-East Land in the beginning of June 1873, *before any melting of snow had commenced*, is also applicable to the ice-wilderness of north Novaya Zemlya.

As on Spitzbergen the ice-field here is doubtless interrupted by deep bottomless clefts, over which the snowstorms of winter throw fragile snow-bridges, which conceal the openings of the abysses so completely that one may stand close to their edge without having any suspicion that a step further is certain death to the man, who, without observing the usual precaution

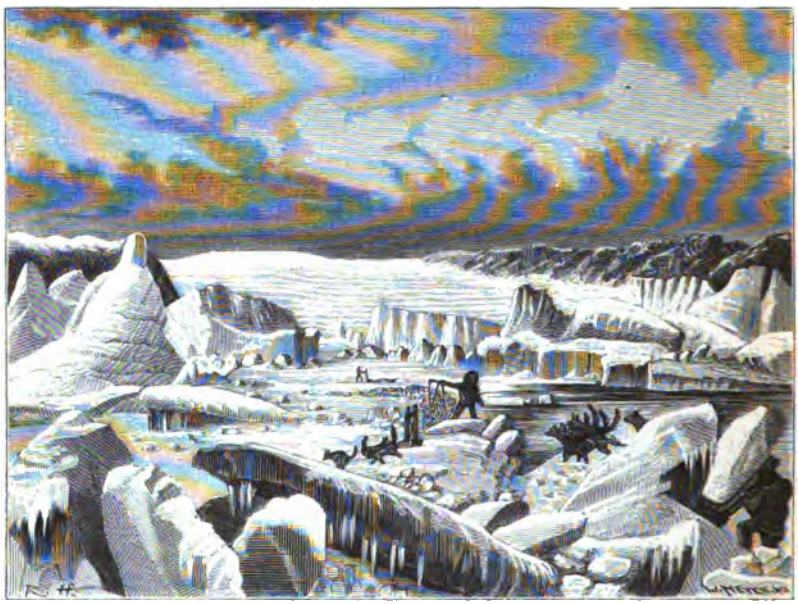
of being bound by a rope to his companions, seeks his way over the blinding-white, almost velvet-like, surface of this snow-field, hard packed indeed, but bound together by no firm crust. If a man, after taking necessary precautions against the danger of tumbling down into these crevasses, betakes himself farther into the country in the hope that the apparently



VIEW FROM THE INLAND-ICE OF GREENLAND.
After a drawing by S. Berggren, 23rd July, 1870.

even surface of the snow will allow of long day's marches, he is soon disappointed in his expectations; for he comes to regions where the ice is everywhere crossed by narrow depressions, *canals*, bounded by dangerous clefts, with perpendicular walls up to fifteen metres in height. One can cross these depressions

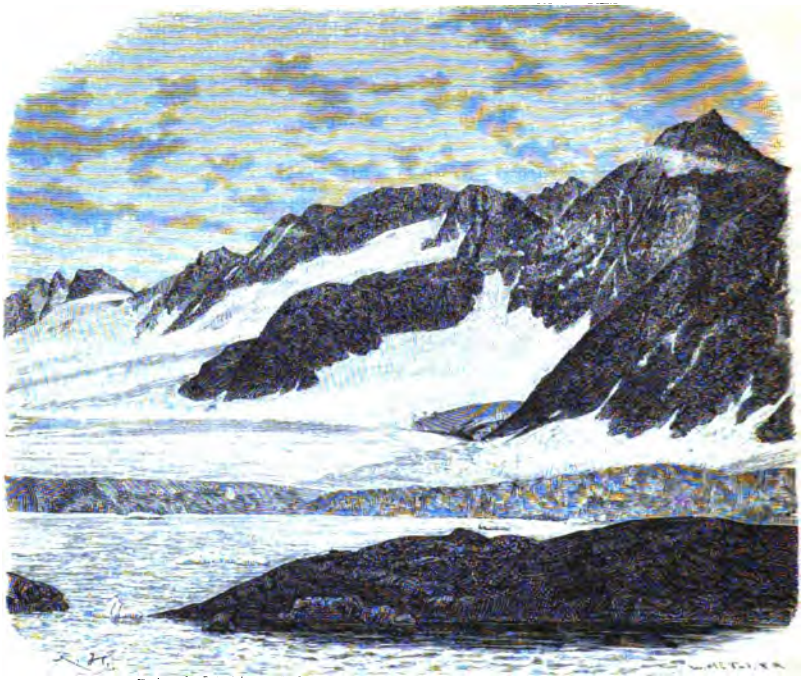
only after endless zigzag wanderings, at places where they have become filled with snow and thereby passable. In summer again, when the snow has melted, the surface of the ice-wilderness has quite a different appearance. The snow has disappeared and the ground is now formed of a blue ice, which however is not clean, but everywhere rendered dirty by



GREENLAND ICE FJORD.

After a design drawn and lithographed by a Greenland Eskimo

a grey argillaceous dust, carried to the surface of the glacier by wind and rain, probably from distant mountain heights. Among this clay, and even directly on the ice itself, there is a scanty covering of low vegetable organisms. The ice-deserts of the Polar lands are thus the habitat of a peculiar flora, which, insignificant as it appears to be, forms however



SLOWLY-ADVANCING GLACIER,

At Foul Bay, on the west coast of Spitzbergen, after a photograph taken by A. Envall, 30th August, 1872.

GLACIER WITH STATIONARY FRONT,

Udde Bay, on Novaya Zemlya, after a drawing by Hj. Théel (1875).

an important condition for the issue of the conflict which goes on here, year after year, century after century, between the sun and the ice. For the dark clay and the dark parts of plants absorb the warm rays of the sun better than the ice, and therefore powerfully promote its melting. They eat themselves down in perpendicular cylindrical holes thirty to sixty centimetres in depth, and from a few millimetres to a whole metre in diameter. The surface of the ice is thus destroyed and broken up.

After the melting of the snow there appears besides a number of inequalities, and the clefts previously covered with a fragile snow-bridge now gape before the wanderer where he goes forward, with their bluish-black abysses, bottomless as far as we can depend on ocular evidence. At some places there are also to be found in the ice extensive shallow depressions, down whose sides innumerable rapid streams flow in beds of azure-blue ice, often of such a volume of water as to form actual rivers. They generally debouch in a lake situated in the middle of the depression. The lake has generally an underground outlet through a grotto-vault of ice several thousands of feet high. At other places a river is to be seen, which has bored itself a hole through the ice-sheet, down which it suddenly disappears with a roar and din which are heard far and wide, and at a little distance from it there is projected from the ice a column of water, which, like a geyser with a large intermittent jet in which the water is mixed with air, rises to a great height.

Now and then a report is heard, resembling that of a cannon shot fired in the interior of the icy mass. It is a new crevasse that has been formed, or if one is near the border of the ice-desert, an ice-block that has fallen down into the sea. For, like ordinary collections of water, an ice-lake also has its outlet into the sea. These outlets are of three kinds, viz., *ice-rapids*, in which the thick ice-sheet, split up and broken in pieces, is pressed forward at a comparatively high speed down a narrow

steeply-sloping valley, where ice-blocks tumble on each other with a crashing noise and din, and from which true icebergs of giant-like dimensions are projected in hundreds and thousands; *broad, slowly-advancing glaciers*, which terminate towards the sea with an even perpendicular face, from which now and then considerable ice-blocks, but no true icebergs, fall down; and *smaller stationary glaciers*, which advance so slowly that the ice in the brim melts away about as fast as the whole mass of ice glides forward, and which thus terminate at the beach not with a perpendicular face but with a long ice-slope covered with clay, sand, and gravel.

The inland-ice on Novaya Zemlya is of too inconsiderable extent to allow of any large icebergs being formed. There are none such accordingly in the Kara Sea,[1] and it is seldom that even a large glacier ice-block is to be met with drifting about.

The name ice-house, conferred on the Kara Sea by a famous Russian man of science, did not originate from the large number of icebergs,[2] but from the fact that the covering of

[1] Sometimes, however, icebergs are to be met with in the most northerly part of the Kara Sea and on the north coast of Novaya Zemlya, whither they may drive down from Franz Josef Land or from other yet unknown Polar lands lying farther north.

[2] In most of the literary narratives of Polar journeys colossal icebergs play a very prominent part in the author's delineations both with the pencil and the pen. The actual fact, however, is that icebergs occur in far greater numbers in the seas which are yearly accessible than in those in which the advance of the Polar travellers' vessel is hindered by impenetrable masses of ice. If we may borrow a term from the geography of plants to indicate the distribution of icebergs, they may be said to be more *boreal* than *polar* forms of ice. All the fishers on the coast of Newfoundland, and most of the captains on the steamers between New York and Liverpool, have some time or other seen true icebergs, but to most north-east voyagers this formation is unknown, though the name iceberg is often in their narratives given to glacier ice-blocks of somewhat considerable dimensions. This, however, takes place on the same ground and with the same justification as that on which the dwellers on the Petchora consider Bolschoj-Kamen a very high mountain. But although no true icebergs are ever formed at the glaciers so common on Spitzbergen and also on

ice, which during winter, on account of the severity of the cold and the slight salinity of the surface-water, is immensely thick, cannot, though early broken up, be carried away by the marine currents and be scattered over a sea that is open even during winter.[1] Most of the ice formed during winter in the Kara Sea, and perhaps some of that which is drifted down from the Polar basin, is on the contrary heaped by the marine currents against the east coast of Novaya Zemlya, where during early summer it blocks the three sounds which unite the Kara Sea with the Atlantic. It was these ice-conditions which caused the failure of all the older north-east voyages and gave to the Kara Sea its bad report and name of ice-house. Now we know that it is not so dangerous in this respect as it was formerly believed to be—that the ice of the Kara Sea melts away for the most part, and that during autumn this sea is quite available for navigation.

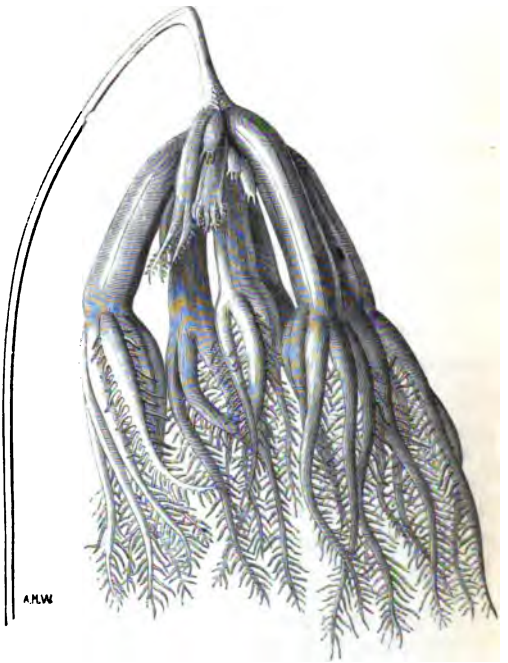
In general our knowledge of the Kara Sea some decades back was not only incomplete, but also erroneous. It was believed that its animal life was exceedingly scanty, and that algæ were absolutely wanting; no soundings had been taken elsewhere than close to the coast; and much doubt was thrown, not without reason, on the correctness of the maps. Now all this is changed to a great extent. The coast line, bordering on the sea, is settled on the maps; the ice-conditions, currents and depth of water in different parts of the sea are ascertained, and

North Novaya Zemlya, it however often happens that large blocks of ice fall down from them and give rise to a swell, which may be very dangerous to vessels in their neighbourhood. Thus a wave caused by the falling of a piece of ice from a glacier on the 23rd (13th) of June, 1619, broke the masts of a vessel anchored at Bell Sound on Spitzbergen, threw a cannon overboard, killed three men, and wounded many more (Purchas, iii., p. 734). Several similar adventures, if on a smaller scale, I could relate from my own experience and that of the walrus-hunters. Care is taken on this account to avoid anchoring too near the perpendicular faces of glaciers.

[1] It may, however, be doubted whether the *whole* of the Kara Sea is completely frozen over in winter.

we know that the old ideas of its poverty in animals and plants are quite erroneous.

In respect to depth the Kara Sea is distinguished by a special regularity, and by the absence of sudden changes. Along the east coast of Novaya Zemlya and Vaygats Island there runs a channel, up to 500 metres in depth, filled with cold salt-water, which forms the haunt of a fauna rich not only in individuals, but also in a large number of remarkable and rare types, as Umbellula, Elpidia, Alecto, asterids of many kinds, &c. Towards the east the sea-bottom



B

UMBELLULA FROM THE KARA SEA.

A

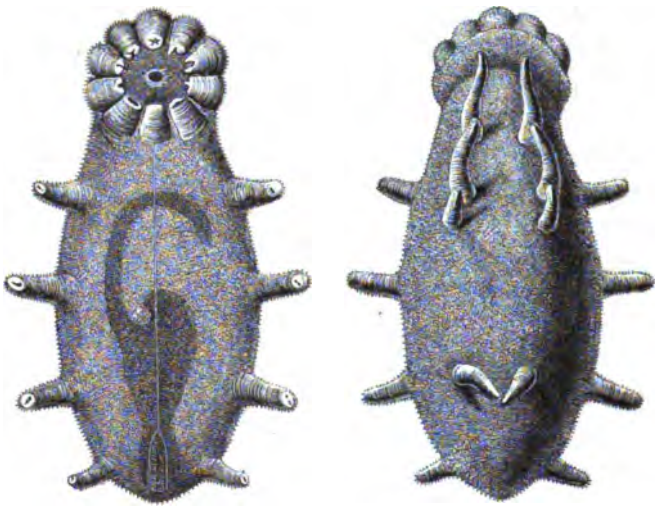
A. Polype stem entire, one-half the natural size.
B. Polype stem, upper part, one-third the natural size.

rises gradually and then forms a plain lying 30 to 90 metres below the surface of the sea, nearly as level as the surface of the superincumbent water. The bottom of the sea in the south and west parts of it consists of clay, in the regions of Beli Ostrov of sand, farther north of gravel. Shells of crustacea and pebbles are here often surrounded by bog-ore formations, resembling the figures on page 186. These also occur over an extensive area north-east of Port Dickson in such quantity that they might be used for the manufacture of iron, if the region were less inaccessible.

Even in the shallower parts of the Kara Sea the water at the bottom is nearly as salt as in the Atlantic Ocean, and all the year round cooled to a temperature of —2° to —2°·7. The surface-water, on the contrary, is very variable in its composition, sometimes at certain places almost drinkable, and in summer often strongly heated. The remarkable circumstance takes place here that the surface water in consequence of its limited salinity freezes to ice if it be exposed to the temperature which prevails in the salt stratum of water next the bottom, and that it forms a deadly poison for many of the decapoda, worms, mussels, crustacea and asterids which crawl in myriads among the beds of clay or sand at the bottom.

At many places the loose nature of the bottom does not permit the existence of any algæ, but in the neighbourhood of Beli Ostrov, Johannesen discovered extensive banks covered with "sea-grass" (algæ), and from the east coast of Novaya Zemlya Dr. Kjellman in 1875 collected no small number of algæ,[1] being thereby enabled to take exception to the old erroneous statements as to the nature of the marine flora. He has drawn up for this work a full account of the

[1] Already in 1771 one of Pallas' companions, the student Sujeff, found large algæ in the Kara Sea (Pallas, *Reise*. St. Petersburg, 1771—1776, iii. p. 34).



A B

ELPIDIA GLACIALIS (THÉEL), FROM THE KARA SEA.
Magnified three times.
A. Belly. B. Back.

MANGANIFEROUS IRON-ORE FORMATIONS FROM THE KARA SEA.
Half the natural size.

marine vegetation in the Kara Sea, which will be found further on.

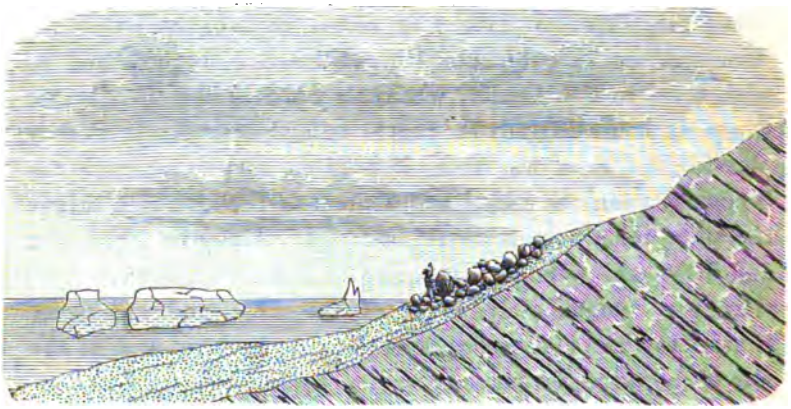
I shall now return to the account of our passage across this sea. On this subject my journal contains the following notes:

August 2nd. Still glorious weather—no ice. The *Lena* appears to wish to get away from the other vessels, and does not observe the flag which was hoisted as the signal agreed upon beforehand that her Captain should come on board, or at least bring his little vessel within hail. The *Fraser* was therefore sent in pursuit, and succeeded in overtaking her towards night.

August 3rd. In the morning Captain Johannesen came on board the *Vega*. I gave him orders to take on board Dr. Almquist and Lieutenants Hovgaard and Nordquist, and go with them to Beli Ostrov, where they should have freedom for thirty-six hours to study the people, animals, and plants, as they pleased; the *Lena* was then, if possible, to pass through the Sound between the island and Yalmal to Port Dickson, where the three other vessels should be found. Almquist, Nordquist, and Hovgaard were already quite in order for the excursion; they went immediately on board the *Lena*, and were soon, thanks to the great power of the engine in proportion to the size of the vessel, far on their way.

In the course of the day we met with very open and rotten ice, which would only have been of use to us by its moderating effect on the sea, if it had not been accompanied by the usual attendant of the border of the ice, a thick fog, which however sometimes lightened. Towards evening we came in sight of Beli Ostrov. This island, as seen from the sea, forms a quite level plain, which rises little above the surface of the water. The sea off the island is of an even depth, but so shallow, that at a distance of twenty to thirty kilometres from the shore there is only from seven to nine metres of water. According to a communication from Captain Schwanenberg, there is, however, a depth of three to four metres close to the north shore. Such

a state of things, that is, a uniform depth, amounting near the shore to from four to ten metres, but afterwards increasing only gradually and remaining unchanged over very extensive areas, is very common in the Arctic regions, and is caused by the ice-mud-work which goes on there nearly all the year round. Another remarkable effect of the action of the ice is that all the blocks of stone to be found in the sea next the beach are forced up on land. The beach itself is formed accordingly at many places, for instance at several points in Matotschkin Sound, of a



SECTION FROM THE SOUTH COAST OF MATOTSCHKIN SOUND,
Showing the origin of Stone-ramparts at the beach.

nearly continuous stone rampart going to the sea level, while in front of it there is a quite even sea bottom without a fragment of stone.

August 4th. In the morning a gentle heaving indicated that the sea was again free of ice, at least over a considerable space to windward. Yesterday the salinity in the water was already diminished and the amount of clay increased; now the water after being filtered is almost drinkable. It has assumed a yellowish-grey colour and is nearly opaque, so that the vessel

appears to sail in clay mud. We are evidently in the area of the Ob-Yenisej current. The ice we sailed through yesterday probably came from the Gulf of Obi, Yenisej or Pjäsina. Its surface was dirty, not clean and white like the surface of glacier-ice or the sea-ice that has never come in contact with land or with muddy river-water. Off the large rivers the ice. when the snow has melted, is generally covered with a yellow layer of clay. This clay evidently consists of mud, which has been washed down by the river-water and been afterwards thrown up by the swell on the snow-covered ice. The layer of snow acts as a filter and separates the mud from the water. The former, therefore, after the melting of the snow may form upon true sea-ice a layer of dirt, containing a large number of minute organisms which live only in fresh water.

August 5th. Still under sail in the Kara Sea, in which a few pieces of ice are floating about. The ice completely disappeared when we came north-west of Beli Ostrov. We were several times in the course of the day in only nine metres of water, which, however, in consequence of the evenness of the bottom, is not dangerous. Fog, a heavy sea, and an intermittent but pretty fresh breeze delayed our progress.

August 6th. At three o'clock in the morning we had land in sight. In the fog we had gone a little way up the Gulf of Yenisej, and so had to turn in order to reach our destination, Port Dickson. The mast-tops of the *Express* were seen projecting over islands to the north, and both vessels soon anchored south of an island which was supposed to be Dickson's Island, but when the *Fraser* soon after joined us we learned that this was a mistake. The shore, which, seen from our first anchorage, appeared to be that of the mainland, belonged in fact to the pretty extensive island, off which the haven itself is situated.

After an excursion on land, in the course of which a covey of partridges was seen, and Dr. Kjellman on the diorite rocks of the island made a pretty abundant collection of plants, belonging

partly to species which he had not before met with in the Arctic regions, we again weighed anchor in order to remove to the proper harbour.

Captain Palander went before in the steam launch in order to examine the yet unsurveyed fairway. On the way he fell in with and killed a bear, an exceedingly fat and large male. Like the bear Dr. Théel shot here in 1875, he had only mosses and lichens in his stomach, and as it is scarcely probable that the bear in this region can catch a great many seals in summer, it is to be supposed that his food consists principally of vegetable substances, with the addition perhaps of a reindeer or two when he can succeed in getting hold of them. In the year 1875 we saw here an old male bear that appeared to pasture quite peaceably in company with some reindeer, probably with a view to get near enough to spring upon them. Bears must besides be very common in that part of the north coast of Siberia, for during the few days we now remained there, two more were shot, both of them very fat.

The haven, which has now been surveyed by Lieutenant Bove, was discovered by me in 1875 and named Port Dickson. It is the best known haven on the whole north coast of Asia, and will certainly in the future be of great importance for the foreign commerce of Siberia. It is surrounded on all sides by rocky islands, and is thus completely sheltered. The anchorage is a good clay bottom. The haven may be entered both from the north and from the south-west; but in sailing in, caution should be used, because some rocky shoals may be met with which are not shown on Lieutenant Bove's sketch chart, which was made in the greatest haste. The water probably varies considerably as to its salinity with the season of the year and with ebb and flood tides, but is never, even at the surface, completely fresh. It can therefore be used in cooking only in case of the greatest necessity. But two streams on the mainland, one debouching north and the other south of the harbour, yield

an abundant supply of good water, in case snow water cannot be obtained from any of the beds of snow which up to autumn are to be found at several places along the strand escarpments in the neighbourhood of the harbour.

At our arrival six wild reindeer were seen pasturing on Dickson's Island; one of them was killed by Palander, the others were stalked unsuccessfully. Some bears, as has already been stated, were also seen, and everywhere among the heaps of stones there were numerous remains of the lemming and the fox. With these exceptions there were few of the higher animals. Of birds we thus saw only snow-buntings, which bred among the stone heaps both on the mainland and on the islands, a covey of ptarmigan, a large number of birds, principally species of Tringa and Phalaropus, but not further determined, eiders, black guillemots and burgomasters in limited numbers, and long-tailed ducks and loons in somewhat greater abundance. There are no "down islands," and as there are no precipitous shore cliffs neither are there any looneries. A shoal of fish was seen in Lena Sound, and fish are probably exceedingly abundant. Seals and white whales also perhaps occur here at certain seasons of the year in no small numbers. It was doubtless with a view to hunt these animals that a hut was occupied, the remains of which are visible on one of the small rocky islands at the north entrance into the harbour. The ruin, if we may apply the term to a wooden hut which has fallen in pieces, showed that the building had consisted of a room with a fireplace and a storehouse situated in front, and that it was only intended as a summer dwelling for the hunters and fishers who came hither during the hunting season from the now deserted *simovies*[1] lying farther south.

I am convinced that the day will come when great warehouses and many dwellings inhabited all the year round will be found at Port Dickson. Now the region is entirely uninhabited as far

[1] Dwellings intended both for winter and summer habitation.

MAP

OF THE

MOUTH OF THE YENISEJ

FROM

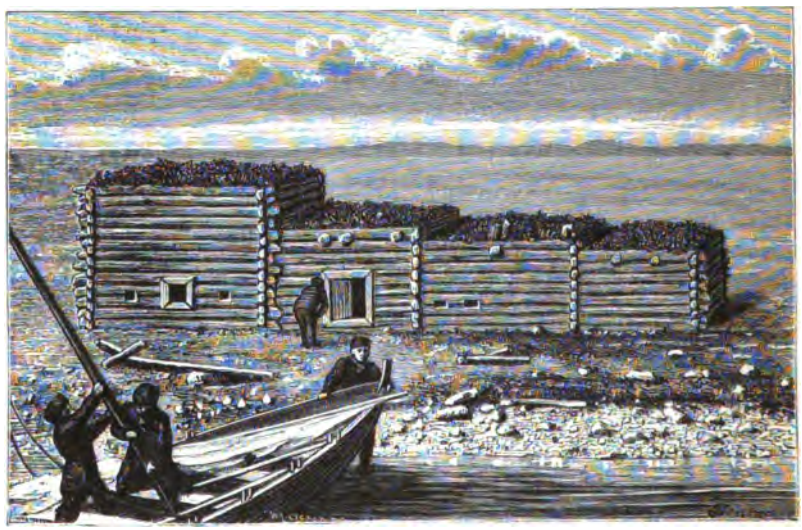
ATLAS RUSSICUS CURA ET OPERE ACADEMIÆ IMPERIALIS SCIENTIARUM PETROPOLITANÆ. PETROPOLI 1745.

as Goltschicha, although, as the map reproduced here shows, numerous dwelling-houses were to be found built along the river bank and sea-shore beyond the mouth of the Yenisej and as far as to the Pjäsina. They have long since been abandoned, in the first place in consequence of the hunting falling off, but probably also because even here, far away on the north coast of Siberia, the old simple and unpretentious habits have given way to new wants which were difficult to satisfy at the time when no steamers carried on traffic on the river Yenisej. Thus, for instance, the difficulty of procuring meal some decades back, accordingly before the commencement of steam communication on the Yenisej, led to the abandonment of a *simovie* situated on the eastern bank of the river in latitude 72° 25′ north.

The *simovies* at the mouth of the Yenisej formed in their time the most northerly fixed dwelling-places of the European races.[1] Situated as they were at the foot of the cold *tundra*, exposed to continual snowstorms in winter and to close fogs during the greater part of summer, which here is extremely short, it seems as if they could not offer their inhabitants many opportunities for enjoyment, and the reason why this tract was chosen for a residence, especially in a country so rich in fertile soil as Siberia, appears to be difficult to find. The remains of an old *simovie* (Krestovskoj), which I saw in 1875 while travelling up the river along with Dr. Lundström and Dr. Stuxberg, however, produced the impression that a true home life had once been led there. Three houses with turf-covered

[1] The most northerly fixed dwelling-place, which is at present inhabited by Europeans, is the Danish commercial post Tasiusak, in north-western Greenland, situated in 73° 24′ N.L. How little is known, even in Russia, of the former dwellings at the mouth of the Yenisej may be seen from *Neueste Nachrichten über die nördlichste Gegend von Sibirien zwischen den Flüssen Pjässida und Chatanga in Fragen und Antworten abgefasst. Mit Einleitung und Anmerkungen vom Herausgeber* (K. E. v. Baer und Gr. v. Helmersen, *Beiträge zur Kenntniss des russischen Reiches*, vol. iv. p. 269. St. Petersburg, 1841).

roofs then still remained in such a state that one could form an idea of their former arrangement and of the life which had been carried on in them. Each cabin contained a whole labyrinth of very small rooms; dwelling-rooms with sleeping places fixed to the walls, bake-rooms with immense fireplaces, bathing houses with furnaces for vapour-baths, storehouses for train-oil with large train-drenched blubber troughs hollowed out of



RUINS OF A SIMOVIE AT KRESTOVSKOJ.
After a drawing by A. Stuxberg.

enormous tree-stems, blubber tanks with remains of the white whale, &c., all witnessing that the place had had a flourishing period, when prosperity was found there, when the home was regarded with loyalty, and formed in all its loneliness the central point of a life richer perhaps in peace and well-being than one is inclined beforehand to suppose.

In 1875 a "prikaschik" (foreman) and three Russian labourers lived all the year round at Goltschicha. Sverevo was

inhabited by one man and Priluschnoj by an old man and his son. All were poor; they dwelt in small turf-covered cabins, consisting of a lobby and a dirty room, smoked and sooty, with a large fireplace, wooden benches along the walls, and a sleeping place fixed to the wall, high above the floor. Of household furniture only the implements of fishing and the chase were numerously represented. There were in addition pots and pans, and occasionally a tea-urn. The houses were all situated near the river-bank, so high up that they could not be reached by the spring inundations. A disorderly midden was always to be found in the near neighbourhood, with a number of draught dogs wandering about on it seeking something to eat. Only one of the Russian settlers here was married, and we were informed that there was no great supply of the material for Russian housewives for the inhabitants of these regions. At least the Cossack Feodor, who in 1875 and 1876 made several unsuccessful attempts to serve me as pilot, and who himself was a bachelor already grown old and wrinkled, complained that the fair or weaker sex was poorly represented among the Russians. He often talked of the advantages of mixed marriages, being of opinion, under the inspiration of memory or hope, I know not which, that a Dolgan woman was the most eligible *parti* for a man disposed to marry in that part of the world.

A little farther south, but still far north of the limit of trees, there are, however, very well-to-do peasants, who inhabit large *simovies*, consisting of a great number of houses and rooms, in which a certain luxury prevails, where one walks on floor-coverings of skins, where the windows are whole, the sacred pictures covered with plates of gold and silver, and the walls provided with mirrors and covered with finely coloured copper-plate portraits of Russian Czars and generals. This prosperity is won by traffic with the natives, who wander about as nomads on the *tundra* with their reindeer herds.

The cliffs around Port Dickson consist of diorite, hard and

difficult to break in pieces, but weathering readily. The rocky hills are therefore so generally split up that they form enormous stone mounds. They were covered with a great abundance of lichens, and the plains between them yielded to Dr. Kjellman the following phanerogamous plants:

Cineraria frigida RICHARDS.
Erigeron uniflorus L.
Saussurea alpina DC.
Taraxacum phymatocarpum J. VAHL.
Gymnandra Stelleri CH. & SCHL.
Pedicularis sudetica WILLD.
„ hirsuta L.
„ Oederi VAHL.
Eritrichium villosum BUNGE.
Myosotis silvatica HOFFM.
Astragalus alpinus L.
Oxytropis campestris (L.) DC.
Dryas octopetala L.
Sieversia glacialis R. BR.
Potentilla emarginata PURSH.
Saxifraga oppositifolia L.
„ bronchialis L.
„ Hirculus L.
„ stellaris L.
„ nivalis L.
„ hieraciifolia WALDST. & KIT.
„ punctata L.
„ cernua L.
„ rivularis L.
„ cæspitosa L.
Chrysosplenium alternifolium L.
Rhodiola rosea L.
Parrya macrocarpa R. BR.
Cardamine pratensis L.
„ bellidifolia L.
Eutrema Edwardsii R. BR.
Cochlearia fenestrata R. BR.
Draba alpina L.
„ oblongata (R. BR.) DC.
„ corymbosa R. BR.
„ Wahlenbergii HN.
„ altaica (LEDEB.) BUNGE.
Papaver nudicaule L.
Ranunculus pygmæus WG.
Ranunculus hyperboreus ROTTB.
„ lapponicus L.
„ nivalis L.
„ sulphureus SOL.
„ affinis R. BR.
Caltha palustris L.
Wahlbergella apetala (L.) FR.
Stellaria Edwardsii R. BR.
Cerastium alpinum L.
Alsine arctica FENZL.
„ macrocarpa FENZL.
„ rubella WG.
Sagina nivalis FR.
Oxyria digyna (L.) HILL.
Rumex arcticus TRAUTV.
Polygonum viviparum L.
„ Bistorta L.
Salix polaris WG.
Festuca rubra L.
Poa cenisea ALL.
„ arctica R. BR.
Glyceria angustata R. BR.
Catabrosa algida (SOL.) FR.
„ concinna TH. FR.
Colpodium latifolium R. BR.
Dupontia Fisheri R. BR.
Koeleria hirsuta GAUD.
Aira cæspitosa L.
Alopecurus alpinus SM.
Eriophorum angustifolium ROTH.
„ vaginatum L.
„ Scheuchzeri HOPPE.
Carex rigida GOOD.
„ aquatilis WG.
Juncus biglumis L.
Luzula hyperborea R. BR.
„ arctica BL.
Lloydia serotina (L.) REICHENB.

Our botanists thus made on land a not inconsiderable collection, considering the northerly position of the region. On the other hand no large algæ were met with in the sea, nor was it to be expected that there would, for the samples of water

SIKVERSIA GLACIALIS R. BR.
From Port Dickson.

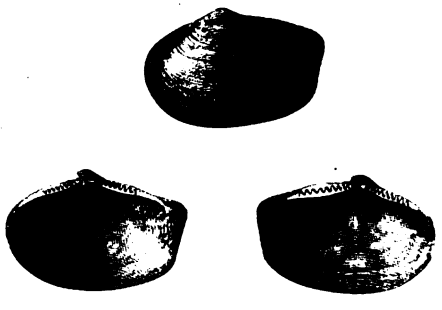
taken up with Ekman's instrument showed that the salinity at the bottom was as slight as at the surface, viz. only 0·3 per cent. The temperature of the water was also at the time of

our visit about the same at the bottom as at the surface, viz. + 9° to + 10°. In spring, when the snow melts, the water here is probably quite fresh, in winter again cold, and as salt as at the bottom of the Kara Sea. Under so variable hydrographical conditions we might have expected an exceedingly scanty marine fauna, but this was by no means the case. For the dredgings in the harbour gave Dr. Stuxberg a not inconsiderable yield, consisting of the same types as those which are found in the salt water at the bottom of the Kara Sea. This circumstance appears to show that certain evertebrate types can endure a much greater variation in the temperature and salinity of the water than the algæ, and that there is a number of species which, though as a rule they live in the strongly cooled layer of salt water at the bottom of the Kara Sea, can bear without injury a considerable diminution in the salinity of the water and an increase of temperature of about 12°.

For the science of our time, which so often places the origin of a northern form in the south, and *vice versâ*, as the foundation of very wide theoretical conclusions, a knowledge of the types which can live by turns in nearly fresh water of a temperature of + 10°, and in water cooled to − 2°·7 and of nearly the same salinity as that of the Mediterranean, must have a certain interest. The most remarkable were, according to Dr. Stuxberg, the following: a species of Mysis, *Diastylis Rathkei* KR., *Idothea entomon* LIN., *Idothea Sabinei* KR., two species of Lysianassida, *Pontoporeia setosa* STBRG., *Halimedon brevicalcar* GOËS, an Annelid, a Molgula, *Yoldia intermedia* M. SARS, *Yoldia* (?) *arctica* GRAY, and a Solecurtus.

Driftwood in the form both of small branches and pieces of roots, and of whole trees with adhering portions of branches and roots, occurs in such quantities at the bottom of two well-protected coves at Port Dickson, that the seafarer may without difficulty provide himself with the necessary stock of fuel. The

great mass of the driftwood which the river bears along, however, does not remain on its own banks, but floats out to sea to drift about with the marine currents until the wood has absorbed so much water that it sinks, or until it is thrown up on the shores of Novaya Zemlya, the north coast of Asia, Spitzbergen or perhaps Greenland.



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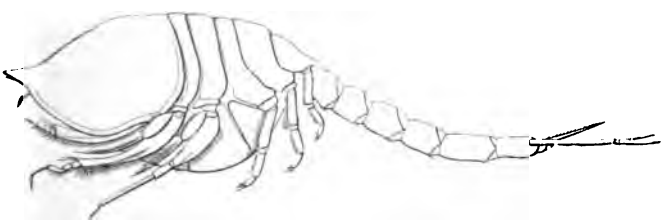


B

EVERTEBRATES FROM PORT DICKSON.

A. Yoldia arctica GRAY. One and two-thirds of natural size. B. Diastylis Rathkei KR. Magnified three times.

Another portion of the wood sinks, before it reaches the sea, often in such a way that the stems stand upright in the river bottom, with one end, so to say, rooted in the sand. They may thus be inconvenient for the navigation, at least at the shallower places of the river. A bay immediately off Port Dickson

was almost barred by a natural palisade-work of driftwood stems.

August 7th. The *Vega* coaled from the *Express*. In the evening the *Lena* arrived, 36 hours after the *Vega* had anchored, that is to say, precisely at the appointed time. Concerning this excursion Dr. Almquist reports:

"On the 2nd August we—Hovgaard, Nordquist and I—went on board the *Lena* to make an excursion to Beli Ostrov. We were to land on the south-western headland and there undertake botanical and zoological researches. Thereafter we were to direct some attention to the opposite shore of Yalmal and visit the Samoyeds living there.

"We left the *Vega* at eleven o'clock forenoon. In the course of the day we saw here and there in the south scattered ice, and at half-past ten at night we ran into a large belt, about 300 metres broad, of scattered ice, which lay stretched out from N.E. to S.W. It was passed without difficulty. In the course of the night we now and then fell in with a little scattered ice, and in the morning with a belt of masses of ice of considerable dimensions; sounding constantly in 10 to $3\frac{1}{2}$ metres water we succeeded, notwithstanding the fog and rain, in finding the straits between Beli Ostrov and the mainland, and on the 3rd August at eleven o'clock forenoon we anchored a little to the east of the southern extremity of the island. The *Lena* lay in $3\frac{1}{2}$ metres water, about an English mile out to sea. The water was shallow for so great a distance from the beach that we had to leave our boat about 300 metres out to sea and wade to land.

"Beli Ostrov consists entirely of fine sand, and only on that part of the beach which is washed by the sea-water did we see any stones as large as walnuts; higher up we did not find a piece of stone even of the size of the nail. The highest point of the island appears to be scarcely three metres above the surface of the sea. That part of the island over which the sea water washes, that is, the beach and the deep bays which indent the land here and there, shows the fine sand bare, without trace of vegetation. Where the ground rises a little, it becomes covered with a black and white variegated covering of mosses and lichens; scattered among which at long intervals are small tufts of grass. First somewhat higher up, and properly only round the marshy margins of the numerous small fresh-water lakes and in hollows and bogs, is the ground slightly green. The higher

plants are represented by only 17 species, all small and stunted,[1] most of them rising only some few lines above the sand. Very few plants reached a height of 15 centimetres. No kind of willow was found, nor any flower seen of any other colour than green or white.

"The lichen-flora too was scanty. No species showed any great luxuriance, and seldom did the black and white lichen-crust produce any 'apothecium.' The lichen-vegetation was most abundant on the driftwood of the beach and on the tufts in the marshes. The larger lichens, as the reindeer and Iceland lichens, occurred very sparingly. About 80 species were found. The land evertebrates were so sparingly represented, that only three diptera, one species of hymenoptera, and some insect larvæ and spiders could be collected. Only poduræ were found in great abundance; they completely covered the whole ground at the beach.

"Several herds of reindeer were seen, but we did not succeed in getting within range of them. A little fish of the Cottus family was caught by Nordquist in a ditch which was in connection with the sea. Driftwood still fresh was found in great abundance, and farther up on land here and there lay a more rotten stem.

"Rain and fog rendered impossible any determination of position. During night we went across the sound and anchored about an English mile and a half from the shore of Yalmal, right opposite some Samoyed tents which we discovered a little inland. In the same unfavourable weather as that of the day before we attempted to land there, but found the water too shallow. First pretty far to the east we succeeded in reaching the beach at a place where the land rose out of the sea with a steep bank about nine metres high. Above the bank, which consisted of loose clay, we found a plain with the appearance of

[1] The collections made here were after our return determined by Dr. Kjellman, who has communicated the following list:

Saxifraga stellaris L.
" cernua L.
" rivularis L.
Cochlearia fenestrata R. Br.
Stellaria humifusa Rottb.
Sagina nivalis Fr.
Arctophila pendulina (Læst.) Ands.
Catabrosa algida (Sol.) Fr.
Dupontia Fisheri R. Br.
Aira cæspitosa L.
Hierochloa pauciflora R. Br.
Eriophorum russeolum Fr.
" Scheuchzeri Hoppe.
Carex salina Wg.
" ursina Desv.
Luzula hyperborea R. Br.
" arctica Bl.

a rich watered *tundra*, full of marshes and streams, and therefore presenting a very green appearance. In order to meet with the Samoyeds we now went westwards, passing several rivulets which cut deeply into the land and had high banks, until after half an hour's walking we came to a broad but not very deep river, which it was impossible to ford. We therefore returned to our boat with the view of seeking a landing-place on the other side of the river; but as the *Lena's* distance from land was considerable and the breeze was freshening, the captain considered that the time at our disposal did not permit us to undertake so long an excursion.

"So far as we may judge from our hasty visit, the vegetation on this part of Yalmal struck us as being remarkably abundant. The high banks especially were richly covered by phanerogamous plants and lichens, and would have deserved a closer examination. Our cursory observations of the plants here may however be interesting for comparison with the flora of Beli Ostrov; we collected and noted the higher plants[1] and about 40 species of lichens. Nordquist found that the fauna resembled that of the neighbouring island, and collected besides two species of Coleoptera.

"After lying 26 hours in the sound we weighed anchor again and went westwards, following a channel with ten to sixteen metres water. We could not find its course farther to the east, and were compelled, although we were near the eastern extremity of Beli Ostrov, to turn in order to pass out through the western entrance of the sound. We saw a quantity of stranded ice on the north coast of the island, which, seen from the sea, did not present any dissimilarity to the part which we had visited. On the 7th August we arrived at Port Dickson."

From Lieutenant Hovgaard's report on this excursion, a map

[1] These according to Dr. Kjellman's determination are:

Saxifraga cernua L.
" cæspitosa L.
Cochlearia fenestrata R. Br.
Draba alpina L.
Ranunculus sulphureus Sol.
" nivalis L.
" pygmæus Wg.
" lapponicus L.
" borealis Trautv.
Stellaria Edwardsii R. Br.
Salix glauca L.
Arctophila pendulina (Læst.) And.
Catabrosa algida (Sol.) Fr.
" concinna Th. Fr.
Dupontia Fisheri R. Br.
Calamagrostis lapponica L.
Carex salina Wg.
" rigida Good.
Eriophorum russeolum Fr.
Luzula arcuata Sm. f. hyperborea R. Br.
Lloydia serotina (L.) Reichenb.

is given here of Beli Ostrov and the neighbouring coast of Yalmal, in which I have named the sound between the island and the mainland after MALYGIN, one of the gallant Russian seamen who first sailed through it nearly a century and a half ago.

Yalmal has been visited by Europeans so seldom, and their observations are scattered in printed papers so inaccessible, that it may perhaps not be out of place here to collect the most important facts which are known regarding this peninsula, along with the necessary bibliographical references.

First as to its name, it is sometimes also written "Yelmert Land," [1] but this is quite incorrect.

"Yalmal" is of Samoyed origin, and has, according to a private communication from the well-known philologist Dr. E. D. EUROPÆUS, the distinctive meaning "land's-end." YELMERT again was a boatswain with the Dutch whale-fisher VLAMINGH, who in 1664 sailed round the northern extremity of Novaya Zemlya to Barents' winter haven, and thence farther to the south-east. Vlamingh himself at his turning-point saw no land, though all signs showed that land ought to be found in the neighbourhood; but several of the crew thought they saw land, and the report of this to a Dutch mapmaker, DICK REMBRANTSZ. VAN NIEROP, led to the introduction of the supposed land into a great many maps, commonly as a large island in the Kara Sea. This island was named Yelmert Land. The similarity between the names Yelmert Land and Yalmal, and the doubt as to the existence of the Yelmert Island first shown on the maps, have led to the transfer of the name Yelmert Land to the peninsula which separates the Gulf of Obi from the Kara Sea. It is to be remarked, however, that the name

[1] On the maps in Linschoten's work already quoted, printed in 1601, and in Blavii *Atlas Major* (1665, t. i. pp. 24, 25), this land is called "Nieu West Vrieslant" and "West Frisia Nova," names which indeed have priority *in print*, but yet cannot obtain a preference over the inhabitants' own beautiful name.

Yalmal is not found in the older accounts of voyages from the European waters to the Obi. The first time I met with it was in the narrative of Skuratov's journey in 1737, as the designation of the most north-easterly promontory of the peninsula which now bears that name.

Yalmal's grassy plains offer the Samoyeds during summer reindeer pastures which are highly valued, and the land is said to have a very numerous population in comparison with other regions along the shores of the Polar Sea, the greater portion, however, drawing southward towards winter with their large herds of reindeer. But the land is, notwithstanding this, among the most imperfectly known parts of the great Russian empire. Some information regarding it we may obtain from sketches of the following journeys:

SELIFONTOV, 1737. In the months of July and August the surveyor Selifontov travelled in a reindeer sledge along the coast of the Gulf of Obi as far as to Beli Ostrov. About this journey unfortunately nothing else has been published than is to be found in LITKE, *Viermalige Reise*, &c., Berlin, 1835, p. 66, and WRANGEL, *Sibirische Reise*, Berlin, 1839, p. 37.

SUJEFF, in 1771, travelled under the direction of Pallas over the southern part of Yalmal from Obdorsk to the Kara Sea, and gives an instructive account of observations made during his journey in PALLAS, *Reise durch verschiedene Provinzen des russischen Reiches*, St. Petersburg, 1771—76, III. pp. 14—35.

KRUSENSTERN, 1862. During his second voyage in the Kara Sea, which ended with the abandonment of the ship *Yermak* on the coast of Yalmal in about 69° 54′ N. L., Krusenstern junior escaped with his crew to the shore, reaching it in a completely destitute condition. He had lost all, and would certainly have perished if he had not near the landing-place fallen in with a rich Samoyed, the owner of two thousand reindeer, who received the shipwrecked men in a very friendly way and conveyed them with his reindeer to Obdorsk, distant

in a straight line 500, but, according to the Samoyed's reckoning, 1,000 versts. In the sketch of Krusenstern's travels, to which I have had access, there is unfortunately no information regarding the tribe with which he came in contact during this remarkable journey.[1]

WALDBURG-ZEIL and FINSCH, 1876. A very full and exceedingly interesting description of the natural conditions in the southernmost part of the peninsula is to be found in the accounts of Count Waldburg-Zeil and Dr. Finsch's journey in the year 1876.[2]

SCHWANENBERG, 1877. Captain Schwanenberg landed on the north part of Beli Ostrov during the remarkable voyage which he made in that year from the Yenisej to St. Petersburg. No traces of men, but some of reindeer and bears, were visible. The sea was sufficiently deep close to the shore for vessels of light draught, according to a private communication which I have received from Captain Schwanenberg.

THE SWEDISH EXPEDITION, 1875. During this voyage we landed about the middle of the west coast of Yalmal. In order to give an idea of the nature of the country, I make the following extract from my narrative of the voyage,[3] which has had but a limited circulation:

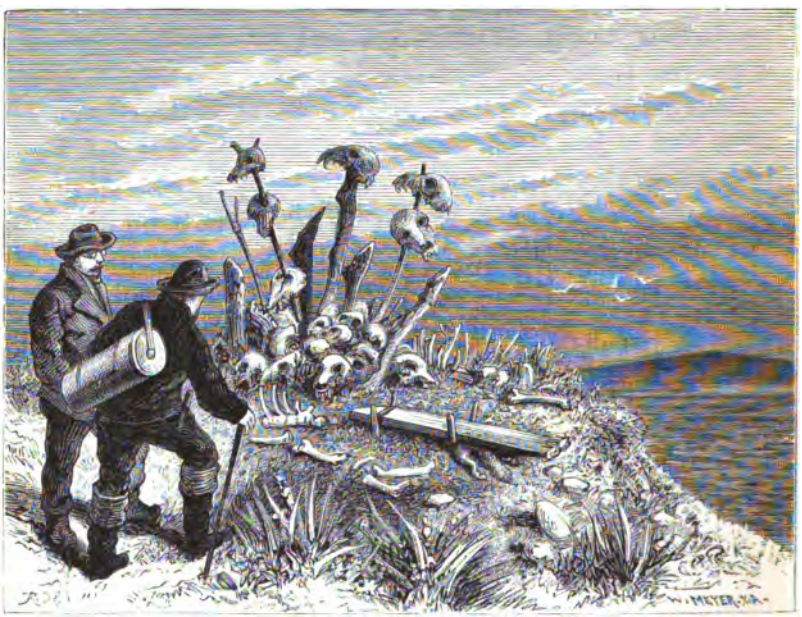
"In the afternoon of the 8th August I landed, along with Lundström and Stuxberg, on a headland projecting a little from Yalmal, on the north side of the mouth of a pretty large river.

[1] Paul von Krusenstern, *Skizzen aus seinem Seemannsleben.* Hirschberg in Silesia. Farther on I intend to give a more detailed account of von Krusenstern's two voyages in the Kara Sea.

[2] *Deutsche Geogr. Blätter* von Lindemann Namens d. Geogr. Gesellsch., Bremen. I. 1877. II. 1878. O. Finsch, *Reise nach West-Sibirien im Jahre* 1876. Berlin, 1879. A bibliographical list has been drawn up by Count von Waldburg-Zeil under the title, *Litteratur-Nachweis für das Gebiet des unteren Ob.*

[3] Nordenskiöld, *Redogörelse för en expedition till mynningen af Jenisej och Sibirien år* 1875, Bih. till Kongl. Vet.-Ak. Handl, vol. iv., No. 1, p. 38-42.

The landing place was situated in lat. 72° 18′, long. 68° 42′. The land was bounded here by a low beach, from which at a distance of one hundred paces a steep bank rose to a height of from six to thirty metres. Beyond this bank there is an extensive, slightly undulating plain, covered with a vegetation which indeed was exceedingly monotonous, but much more luxuriant than



PLACE OF SACRIFICE ON YALMAL.
After a drawing by A. N. Lundström.

that of Vaygats Island or Novaya Zemlya. The uniformity of the vegetation is perhaps caused, in a considerable degree, by the uniform nature of the terrain. There is no solid rock here. The ground everywhere consists of sand and sandy clay, in which I could not find a stone so large as a bullet or even as a pea, though I searched for a distance of several kilometres along the

strand-bank. Nor did the dredge bring up any stones from the sea-bottom off the coast, a circumstance which, among other things, is remarkable, because it appears to show that the strand-ice from the Obi and Yenisej does not drift down to and melt in this part of the Kara Sea. Nor do the sand beds contain any sub-fossil shells, as is the case with the sand beds of the Yenisej *tundra*. 'Noah's wood' also appears to be absent here. To judge from our observations at this place, the peninsula between the Gulf of Obi and the Kara Sea thus differs very essentially from the *tundra* lying east of the Yenisej.

"We saw no inhabitants, but everywhere along the beach numerous traces of men—some of them barefoot—of reindeer, dogs and Samoyed sleighs, were visible. On the top of the strand-bank was found a place of sacrifice, consisting of forty-five bears' skulls of various ages placed in a heap, a large number of reindeer skulls, the lower jaw of a walrus, &c. From most of the bears' skulls the canine teeth were broken out, and the lower jaw was frequently entirely wanting. Some of the bones were overgrown with moss and lay sunk in the earth; others had, as the adhering flesh showed, been placed there during the present year. In the middle of the heap of bones stood four erect pieces of wood. Two consisted of sticks a metre in length with notches cut in them, serving to bear up the reindeer and bears' skulls, which were partly placed on the points of the sticks or hung up by means of the notches, or spitted on the sticks by four-cornered holes cut in the skulls. The two others, which clearly were the proper idols of this place of sacrifice, consisted of driftwood roots, on which some carvings had been made to distinguish the eyes, mouth, and nose. The parts of the pieces of wood, intended to represent the eyes and mouth, had recently been besmeared with blood, and there still lay at the heap of bones the entrails of a newly-killed reindeer. Close beside were found the remains of a fireplace, and of a midden, consisting of reindeer bones of various kinds and the lower jaws of bears.

"As the sandy slopes of the beach offered no suitable breeding-place for looms, black guillemots, or other sea-fowl, and there were no islands along the coast which could serve as breeding-places for eiders and other species of geese which breed in colonies, the abundant bird-life of the Polar Sea was wanting here. At the mouth of the river, however, large flocks of eiders and long-tailed ducks flew about, and on the sandy banks along the shore, flocks of *Calidris arenaria* and a Tringa or two ran about restlessly seeking their food. The solitude of the *tundra* was broken only by a couple of larks and a pair of falcons (*Falco peregrinus*) with young. Traces of reindeer were also seen, and two fox-traps set on the strand-bank showed that foxes occur in these regions in sufficient numbers to be the object of capture.

"Later in the afternoon, when some solar altitudes had been taken, in order to determine the geographical position of the place, we rowed back to our vessel and sailed on, keeping at some distance from the coast, and at one place passing between the shore and a long series of blocks of ground-ice, which had stranded along the coast in a depth of nine to sixteen metres. During night we passed a place where five Samoyed tents were pitched, in whose neighbourhood a large number of reindeer pastured. The land was now quite low, and the sea had become considerably shallower. The course was therefore shaped for the N.W., in which direction deeper water was soon met with. Notwithstanding the slight salinity and high temperature (+ 7°·7) of the surface water a *Clio borealis* and a large number of Copepoda were taken at the surface."

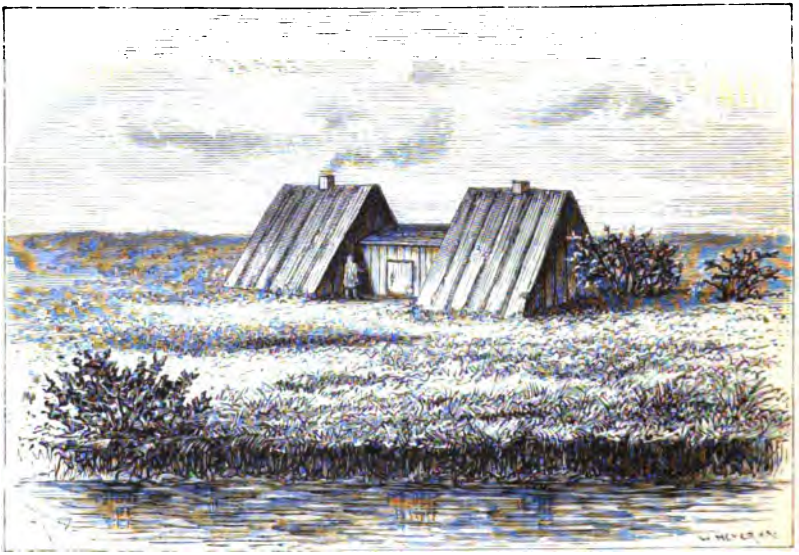
The excursion now described and Almquist's and Hovgaard's landing in 1878 were, as far as I am aware, the only occasions on which naturalists have visited the northern part of that peninsula which separates the Kara Sea from the Obi. The Norwegian hunters also visit the place seldom, the main reasons being the inaccessibility of the shallow east coast, and the want

of harbours. They now, however, land occasionally to take in water, and perhaps to barter the tobacco they have saved from their rations, knives they have no use for, and old-fashioned guns, gunpowder, lead, &c., for the products of the Samoyeds' reindeer husbandry, hunting and fishing. At first the natives fled when they saw the Norwegians coming, and, when they could not make their escape, they saluted them with great humility, falling on their knees and bending their heads to the earth, and were unwilling to enter into any traffic with them or to show them their goods. But since the Samoyeds observed that the Norwegians never did them any harm, the mistrust and excessive humility have completely disappeared. Now a visit of Europeans is very agreeable to them, partly for the opportunity which it offers of obtaining by barter certain articles of necessity, luxury, or show, partly perhaps also for the interruption thereby caused in the monotony of the *tundra* life. When the walrus-hunters row or sail along that open coast, it often happens that natives run backwards and forwards on the shore, and by signs eagerly invite the foreigners to land; if they do so, and there are any wealthy Samoyeds in the neighbourhood, there immediately begins a grand entertainment, according to the customs of the people, with more than one trait reminding us of the sketches from the traditionary periods of the civilised nations.

What I have stated here is about all that we know of Yalmal, and we see from this that a very promising, yet untouched field for researches in ethnography and natural history here lies before future travellers to the Yenisej.

What sort of winter is there at the mouth of the Yenisej? We have for the present no information on this point, as no scientific man has wintered there. But on the other hand we have a very exciting narrative of the wintering of the Fin, NUMMELIN, at the Briochov Islands in the Yenisej in lat. 70° 48′ north.

I visited the place on the 27th August 1875. It consisted of a fishing post, occupied only in summer, and at that season of the year very attractive, surrounded as it is by luxuriant vegetation of grass and bushes. The houses were situated on a sound running between the Briochov Islands, which form the northernmost group of the labyrinth of islands which occupy the channel of the Yenisej between 69½° and 71° N. L. At the



"JORDGAMMOR" ON THE BRIOCHOV ISLANDS.
After a sketch by the Author.

time of our visit the fishing was over for the season and the place deserted. But two small houses and a number of earth-huts (*jordgammor*), all in good repair, stood on the river bank and gave evidence, along with a number of large boats drawn up on land, and wooden vessels intended for salting fish, of the industry which had been carried on there earlier in the summer.

It was at this place that Nummelin passed one of the severest winters that Arctic literature has to record.[1]

In 1876 M. Sidoroff, well known for the lively interest which he takes in navigation in the Siberian waters, had a ship *Severnoe Sianie* (the *Aurora*) built and fitted out at Yeniseisk, in order to carry goods from the Yenisej to Europe. The vessel was placed under the command of a Russian sea-captain, Schwanenberg. Under him Nummelin served as mate, and the vessel had a crew of eighteen men, most of whom had been exiled to Siberia for crime. In consequence of various mishaps the vessel could not get farther the first year than to the neighbourhood of the mouth of the Yenisej, where it was left in winter quarters at the place which has been named above. Nummelin and four exiles remained on board, while Schwanenberg and the rest of the crew returned to Yeniseisk on the 28th September. Frost had already commenced. During the two following weeks the temperature kept in the neighbourhood of the freezing point; clear weather alternating with snow and rain.

On the 5th of October the crew withdrew to their winter quarters, having previously collected driftwood and placed it in heaps in order that they might easily find it under the snow.

On the 16th October the thermometer at eight o'clock in the morning showed −4·5° and afterwards sank lower every day, until after the 21st October the mercury for some days was constantly under −10°. On the 26th October the temperature was −18°, but in the beginning of November it rose again to −2°. On the 6th November it sank again to −17°, but rose on the 11th to −3·5°. On the 14th November the thermometer showed −23·5°,

[1] I give the particulars of this wintering partly after communications made to me in conversation by Nummelin, partly after *Göteborgs Handels- och Sjöfartstidning* for the 20th and 21st November, 1877. This *first* and, as far as I know, only detailed narrative of the voyage in question, was dictated to the editor of that journal, *reference being made to the log* by Schwanenberg and Nummelin. Schwanenberg had come to Gothenburg some days before with his Yeniseisk-built vessel.

on the 21st – 29·5°. Next day in the morning it stood at – 32°, and in the evening at – 37°, but these figures were arrived at *by guess*, the instrument not indicating so low temperatures. This temperature of – 30° to – 32°, varying with frozen mercury, continued till the end of November, when it rose again to – 11·5°. At Christmas there was again a temperature of – 31° and the six following days the mercury was frozen, with which the new year came in. The temperature then rose again to – 20°, but soon sank so that from the 16th January the mercury was frozen for five days. On the 22nd January the reading was – 9°. On the 26th the mercury froze again, and on the 29th the temperature was – 6°. During the month of February the temperature never rose above – 24°; the mercury was frozen on the 20th, 25th, 26th, and 28th. This was the case on the 1st, 3rd, 6th, 7th, 14th, 16th, and 18th March; on the 22nd March the reading was – 7°, on the 30th – 29°. April began with – 31°, but the temperature afterwards rose, so that on the 16th it reached – 11° and varied between – 21° and – 6° (the 25th). On the 2nd May the reading in the morning and evening was – 12°, at mid-day – 2° to – 5°. On the 8th May it was + 0, on the 17th – 10·5°, on the 31st + 0·5°. June began with + 1·5°. On the 8th the reading at mid-day was + 11°, on the morning and evening of the same day + 2° to + 3°. During the remainder of June and the month of July the temperature varied between + 2° and + 21°.

It was in such circumstances that Nummelin and his four companions lived in the ill-provided house of planks on the Little Briochov Island. They removed to it, as has been already said, on the 5th October; on the 20th the ice was so hard frozen that they could walk upon it. On the 26th snowstorms commenced, so that it was impossible to go out of the house.

The sun was visible for the last time on the 21st November, and it reappeared on the 19th January. On the 15th May the sun no longer set. The temperature was then under the freezing point of mercury. That the upper edge of the sun

should be visible on the 19th January we must assume a horizontal refraction of nearly 1°. The islands on the Yenisej are so low that there was probably a pretty open horizon towards the south.

Soon after Christmas scurvy began to show itself. Nummelin's companions were condemned and punished criminals, in whom there was to be expected neither physical nor moral power of resistance to this disease. They all died, three of scurvy, and one in the attempt to cross from the Briochov Islands to a *simovie* at Tolstoinos. In their stead Nummelin succeeded in procuring two men from Tolstoinos, and later on one from Goltschicha. On the 11th May a relief party arrived from the south. It consisted of three men under the mate Meyenwaldt, whom Sidoroff had sent to help to save the vessel. They had first to shovel away he snow which weighed it down. The snow lay nearly six metres deep on the river ice, which was three metres thick. When they at last had got the vessel nearly dug out, it was buried again by a new snowstorm.

In the middle of June the ice began to move, and the river water rose so high that Nummelin, Meyenwaldt, and four men, along with two dogs, were compelled to betake themselves to the roof of the hut, where they had laid in a small stock of provisions and fuel. Here they passed six days in constant peril of their lives.

The river had now risen five metres; the roof of the hut rose but a quarter of a metre above the surface of the swollen river, and was every instant in danger of being carried away by a floating piece of ice. In such a case a small boat tied to the roof was their only means of escape.

The whole landscape was overflowed. The other houses and huts were carried away by the water and the drifting ice, which also constantly threatened the only remaining building. The men on its roof were compelled to work night and day to keep the pieces of ice at a distance with poles.

The great inundation had even taken the migrating birds at unawares. For long stretches there was not a dry spot for them to rest upon, and thus it happened that exhausted ptarmigan alighted among the men on the roof; once a ptarmigan settled on Meyenwaldt's head, and a pair on the dogs.

On the 23rd June the water began to fall, and by the 25th it had sunk so low that Nummelin and his companions could leave the roof and remove to the deserted interior of the house.

The narrative of Nummelin's return to Europe by sea, in company with Schwanenberg, belongs to a following chapter.

CHAPTER V.

The history of the North-east Passage from 1556 to 1878—Burrough, 1556—Pet and Jackman, 1580—The first voyage of the Dutch, 1594—Oliver Brunel—The second voyage, 1595—The third voyage, 1596—Hudson, 1608—Gourdon, 1611—Bosman, 1625—De la Martinière, 1653—Vlamingh, 1664—Snobberger, 1675—Roule reaches a land north of Novaya Zemlya—Wood and Flawes, 1676—Discussion in England concerning the state of the ice in the Polar Sea—Views of the condition of the Polar Sea still divided—Payer and Weyprecht, 1872-74.

THE sea which washes the north coast of European Russia is named by King Alfred (*Orosius*, Book I. Chaps. i. ii.) the Quaen Sea (in Anglo-Saxon *Cwen Sae*),[1] a distinctive name, which unquestionably has the priority, and well deserves to be retained. To the inhabitants of Western Europe the islands, Novaya Zemlya and Vaygats, first became known through Stephen Burrough's voyage of discovery in 1556. Burrough therefore is often called the discoverer of Novaya Zemlya, but incorrectly. For when he came thither he found Russian vessels, manned by hunters well acquainted with the navigable waters and the land. It is clear from this that Novaya Zemlya had then already been known to the inhabitants of Northern Russia for such a length of time that a very actively prosecuted hunting could arise there. It is even probable that in the same way as the northernmost part of Norway was already

[1] In Bosworth's translation this name is replaced by *White Sea*, an unnecessary modernising of the name, and incorrect besides, as the White Sea is only a bay of the ocean which bounds Europe on the north.

known for a thousand years back, not only to wandering Lapps, but also to Norwegians and Quaens, the lands round Yugor Schar and Vaygats were known several centuries before Burrough's time, not only to the nomad Samoyeds on the mainland, but also to various Beorma or Finnish tribes. Probably the Samoyeds then, as now, drove their reindeer herds up thither to pasture on the grassy plains along the coast of the Polar Sea, where they were less troubled by the mosquito and the reindeer fly than further to the south, and probably the wild nomads were accompanied then, as now, by merchants from the more civilised races settled in Northern Russia. The name Novaya Zemlya (New Land), indicates that it was discovered at a later period, probably by Russians, but we know neither when nor how.[1] The narrative of Stephen Burrough's voyage, which, like so many others, has been preserved from oblivion by Hakluyt's famous collection, thus not only forms a sketch of the first expedition of West-Europeans to Novaya Zemlya, but is also the principal source of our knowledge of the earliest Russian voyages to these regions. I shall on this account go into greater detail in the case of this voyage than in those of the other voyages that will be referred to here.

It is self-evident that the new important commercial treaties, to which Chancelor's discovery of the route from England to the White Sea led, would be hailed with great delight both in England and in Russia, and would give occasion to a number of new undertakings. At first, as early as 1555, there was formed in England a company of "merchant adventurers of

[1] The Russian chronicles state that the land between the Dwina and the Petchora (Savolotskaja Tchud) was made tributary under the Slavs in Novgorod during the first half of the ninth century. A monastery is spoken of in the beginning of the twelfth century at the mouth of the Dwina, whence we may conclude that the land was even then partly peopled by Russians, but we want trustworthy information as to the time when the Russian-Finnish Arctic voyages began (compare F. Litke, *Viermalige Reise durch das nördliche Eismeer*. Berlin, 1835, p. 3).

England for the discoverie of landes, territories, isles, dominions, and seigniories unknowen," commonly called "the Muscovy Company." Sebastian Cabot, then almost an octogenarian, was appointed governor for the term of his natural life, and a number of privileges were conferred upon it by the rulers both of England and Russia. At the same time negotiators, merchants, and inquirers were sent by different ways from England to Russia in order to confirm the amity with that country, and more thoroughly examine the, at least to England, new world, which had now been discovered in the East. But a detailed account of these journeys does not enter into the plan of this work.

With this, however, men were not content. They considered Chancelor's voyage as but the first step to something far more important, namely, the opening of the North-East Passage to China and India. While Chancelor himself the year after his return was sent along with several merchants to the White Sea, a further attempt was planned to reach the east coast of Asia by the same route. A small vessel, the *Searchthrift*, was fitted out for this purpose and placed under the command of Stephen Burrough.[1] The most important occurrences during the voyage were the following:—

On the $\frac{\text{3rd May,}}{\text{23rd April,}}$ 1556, the start was made from Ratcliffe to Blackwall and Grays. Here Sebastian Cabot came on board, together with some distinguished gentlemen and ladies. They were first entertained on board the vessel and gave liberal presents to the sailors, alms being given at the same time to a number of poor people, in order that they might pray for good luck and a good voyage; "then at the signe of the Christopher,

[1] The voyage is described in *Hakluyt*, 1st Edition, p. 311. It is inserted in the list of contents in the following terms: "The voyage of Steven Burrough towarde the river Ob, intending the discoverie of the north-east passage. An. 1556." It appears from the introduction to Hakluyt's work that the narrative was revised by Burrough himself. In the text Burrowe is written instead of Burrough.

Master Cabot and his friends banketted, and made them that were in the company great cheere; and for very joy that he had to see the towardness of our intended discovery, he entered into the dance himselfe, amongst the rest of the young and lusty company." At Orwell Burrough left his own vessel, in order, at the wish of the merchants, to make the passage to Vardoehus in the *Edward Bonaventure*. In the end of May he was off the North Cape, which name Burrough says he gave to this northernmost headland of Europe during his first voyage.[1] When Burrough left the *Edward Bonaventure* and went on board his own vessel is not stated, but on the $\frac{17\text{th}}{7\text{th}}$ June he replied on the *Searchthrift* to the parting salute of the *Edward Bonaventure*. On the $\frac{20\text{th}}{10\text{th}}$ June Kola was reached, and its latitude fixed at 65° 48′.[2]

"On Thursday the $\frac{21\text{st}}{11\text{th}}$ June at 6 of the clocke in the morning, there came aboord of vs one of the Russe Lodiaes, rowing with twentie oares, and there were foure and twentie men in her. The master of the boate presented me with a great loafe of bread, and six rings of bread, which they call Colaches, and foure dryed pikes, and a peck of fine otemeale, and I gave vnto the Master of the boate a combe, and a small glasse. He declared vnto me that he was bound to Pechora, and after that I made to drinke, the tide being somewhat broken, they gently departed. The Master's name was Pheother (Feodor). . . . Thursday (the $\frac{28\text{th}}{18\text{th}}$ June) we weyed our ankers in the Riuer Cola, and went into the Sea seuen or eight leagues, where we met with the winde farre Northerly, that of force it constrained vs to goe againe backe into the sayd riuer, where came aboord of vs sundry of their Boates, which declared unto me that they

[1] As I have already mentioned, von Herbertstein states that the Russians (Istoma and others) as early as 1496 sailed round the northern extremity of Norway in boats, which when necessary could be carried over land. North Cape, or rather Nordkyn, was called at that time Murmanski Nos (the Norman Cape). When Hulsius in his collection of travels gives von Herbertstein's account of Istoma's voyage, he considers Swjatoi Nos on the Kola peninsula to be North Cape (Hamel, *Tradescant*, St. Petersburg, 1847, p. 40).

[2] This must be a slip of the pen or an error of the press; it was probably intended to be 68° 48′. Kola lies in 68° 51′ N. L.

were also bound to the northwards, a fishing for Morse and Salmon, and gave me liberally of their white and wheaten bread.

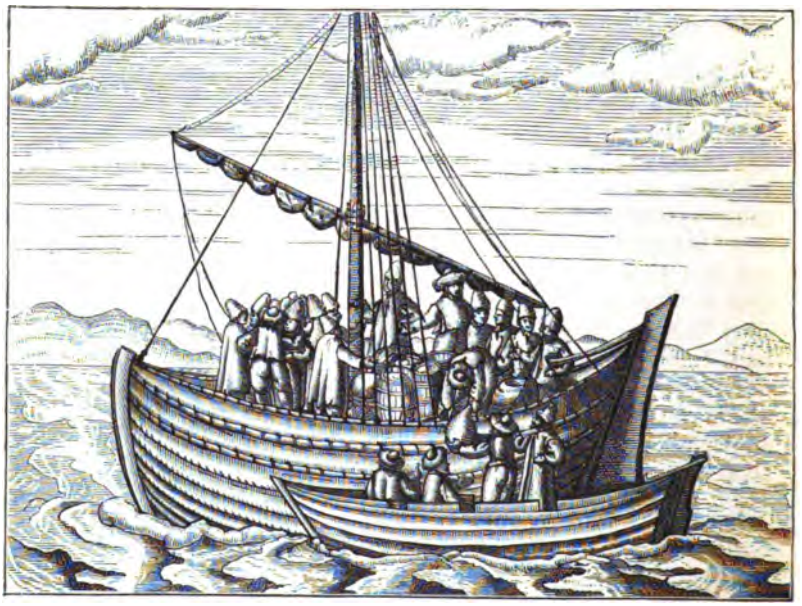
"As we roade in this riuer, wee saw dayly comming downe the riuer many of their Lodias, and they that had least, had foure and twentie men in them, and at the last they grew to thirtie saile of them; and amongst the rest, there was one of them whose name was Gabriel, who shewed me very much friendshippe, and he declared vnto mee that all they were bound to Pechora, a fishing for salmons, and morses: insomuch that hee shewed mee by demonstrations, that with a faire winde we had seuen or eight dayes sailing to the riuer Pechora, so that I was glad of their company. This Gabriel promised to giue mee warning of shoales, as he did indeede. . . . Sunday being the one and twentieth day [of June, 1st July new style], Gabriel gaue mee a barrell of Meade, and one of his speciall friends gaue me a barrell of beere, which was caryed upon mens backs at least 2 miles.

"Munday we departed from the riuer Cola, with all the rest of the said Lodias, but sailing before the wind they were all too good for vs:[1] but according to promise, this Gabriel and his friend did often strike their sayles, and taryed for us forsaking their owne company. Tuesday at an Eastnortheast sunne we were thwart of Cape St. John.[2] It is to be vnderstood, that from the Cape S. John vnto the riuer or bay that goeth to Mezen, it is all sunke land, and full of shoales and dangers, you shall haue scant two fadome water and see no land. And this present day wee came to an anker thwart of a creeke, which is 4 or 5 leagues to the northwards of the sayd Cape,

[1] This statement is very remarkable. For it shows that the vessels, that were then used by the Russians and Fins, were not very inferior as compared with those of the West-Europeans, which is confirmed by the fact, among others, that, nowhere in accounts of the voyages of the English or Dutch in former times to Novaya Zemlya, do we find it stated that in respect to navigation they were very superior to the Kola men. As the Russian-Finnish *lodjas* of the time were probably beyond the influence of the shipbuilding art of Western Europe, it is of importance to collect all that is known about the way in which these vessels were built. Several drawings of them occur in the accounts of the Dutch voyages, but it is uncertain how far they are accurate. According to these the *lodja* was klinker-built, with boards not riveted together but bound fast with willows, as is still occasionally practised in these regions. The form of the craft besides reminds us of that of the present walrus-hunting sloop.

[2] Cape Woronov, on the west side of the mouth of the river Mesen.

into which creeke Gabriel and his fellow rowed, but we could not get in: and before night there were aboue 20 saile that went into the sayd creeke, the wind being at the Northeast. We had indifferent good landfang. This afternoone Gabriel came aboord with his skiffe, and then I rewarded him for the good company that he kept with vs ouer the Shoales, with two small iuory combes, and a steele glasse with two or three trifles



RUSSIAN "LODJA."
After G. de Veer.

more, for which he was not ungratefull. But notwithstanding, his first company had gotten further to the Northwards. Wednesday being Midsummer day we sent our skiffe aland to sound the creeke, where they found it almost drie at a low water. And all the Lodias within were on ground. (In consequence of the threatening appearance of the weather Burrough determined to go into the bay at high water. In doing so he ran aground, but got help from his Russian friends.) Gabriel came out with his skiffe, and so did sundry

others also, shewing their good will to help us, but all to no purpose, for they were likely to have bene drowned for their labour, in so much that I desired Gabriel to lend me his anker, because our owne ankers were too big for our skiffe to lay out, who sent me his owne, and borrowed another also and sent it vs."

After much trouble Burrough succeeded in getting his vessel off the shoal, and then sought for a better anchorage on the other side of Cape St. John.

"Friday ($\frac{6\text{th July}}{26\text{th June}}$) at afternoone we weyed, and departed from thence, the wether being mostly faire, and the winde at East-southeast, and plied for the place where we left our cable and anker, and our hawser, and as soone as we were at an anker the foresaid Gabriel came aboord of vs, with 3 or foure more of their small boats, and brought with them of their Aquauitæ and Meade, professing unto me very much friendship, and reioiced to see vs againe, declaring that they earnestly thought that we had bene lost. This Gabriel declared vnto me that they had saued both the ankers and our hauser, and after we had thus communed, I caused 4 or 5 of them to goe into my cabbin, where I gaue them figs and made them such cheere as I could. While I was banketing of them, there came another of their Skiffes aboord with one who was a Kerill (Karelian), whose name afterwards I learned, and that he dwelt in Colmogro, and Gabriel dwelled in the towne of Cola, which is not far from the river's mouth. This foresaid Keril said vnto me that one of the ankers which I borrowed was his. I gave him thanks for the lone of it, thinking it had bene sufficient. And as I continued in our accustomed maner, that if the present which they brought were worth enterteinment, they had it accordingly, he brought nothing with him, and therfore I regarded him but litle. And thus we ended, and they took their leaue and went ashore. At their comming ashore, Gabriel and Keril were at vnconvenient words, and by the eares, as I vnderstand; the cause was because the one had better enterteinment than the other; but you shal vnderstand that Gabriel was not able to make his party good, because there were 17 lodias of the Keril's company who tooke his part, and but 2 of Gabriel's company. The next high water Gabriel and his company departed from thence, and rowed to their former company and neighbours, which were

in number 28 at the least, and all of them belonging to the river Cola. And as I vnderstood Keril made reckoning that the hauser which was fast in his anker should have bene his owne, and at first would not deliver it to our boat, insomuch that I sent him worde that I would complain vpon him, whereupon he deliuered the hauser to my company. The next day being Saturday, I sent our boat on shore to fetch fresh water and wood, and at their comming on shore this Keril welcomed our men most gently, and also banketed them, and in the meanetime caused some of his men to fill our baricoes with water, and to help our men to beare wood into their boat; and then he put on his best silke coate, and his collar of pearles and came aboorde againe, and brought his present with him: and thus having more respect vnto his present than to his person, because I perceiued him to be vain-glorious, I bade him welcome and gaue him a dish of figs; and then he declared vnto me that his father was a gentleman, and that he was able to shew me pleasure, and not Gabriel, who was but a priest's sonne."

After Burrough has given account of a storm, during which he lost a jolly boat, which he had purchased at Vardoehus, and by which they were detained some time in the neighbourhood of Cape St. John (whose latitude was fixed at 66° 50′) he continues:—

"Saturday (the $\frac{14}{24}$th July) at a Northnorthwest sunne the wind came at Eastnortheast, and then we weied, and plied to the Northwards, and as we were two leagues shot past the Cape, we saw a house standing in a valley, which is dainty to be seene in those parts and by and by I saw three men on the top of the hil. Then I iudged them, as it afterwards proued, that they were men which came from some other place to set traps to take vermin[1] for their furres, which trappes we did perceiue very thicke alongst the shore as we went."

The 14th to the 19th July, new style, were passed on the coast of Kanin Nos.[2] On the 19th at noon Burrough was in

[1] Probably mountain foxes. Remains of these fox-traps are still frequently met with along the coast of the Polar Sea, where the Russians have carried on hunting.

[2] Kanin Nos is in 68° 30′ N. L.

lat. 68° 40′ north. On Friday, the $\frac{19}{29}$th July another storm appeared to threaten.

"And as I was musing what was best to be done, I saw a sail come out of a creeke under the foresayd Caninoz, which was my friend Gabriel, who forsook his harborough and company, and came as neere us as he might, and pointed vs to the Eastwards, and then we weyed and followed him. Saturday we went eastsoutheast and followed Gabriel, and he brought vs into an harborough called Morgiouets, which is 30 leagues from Caninoz. This morning Gabriel saw a smoke on ye way, who rowed vnto it with his skiffe, which smoke was two leagues from the place where we road; and at a Northwest sunne he came aboord again, and brought with him a Samoed,[1] which was but a young man; his apparell was then strange vnto vs, and he presented me with three young wild geese, and one young barnacle."

On the $\frac{24\text{th}}{14\text{th}}$ July Burrough sailed past Dolgoi Island, and the following day entered the mouth of the Petchora, the latitude of which was fixed at 69° 10′.[2] On the $\frac{30\text{th}}{20\text{th}}$ they sailed out again over sandbanks in only five feet of water, and thanked God that their vessel was of so light draught. The day after ice was met with for the first time. On the $\frac{4\text{th Aug.}}{6\text{th July}}$ in lat. 70° 20′ north, they had the meeting already described with an enormous whale.[3] Somewhat later on the same day the *Searchthrift* anchored in a good haven between two islands, situated in 70° 42′ N. L.[4] They were named by Burrough St. James's Islands.

"Tuesday, the $\frac{7\text{th Aug.}}{27\text{th July}}$ we plyed to the Westwards alongst the shoare, the wind being at Northwest, and as I was about to come to anker, we saw a sail comming about the point whereunder we thought to have ankered. Then I sent a skiffe aboorde of him, and at their comming aboord, they tooke acquaintance of them, and the chiefe man said hee had bene

[1] This was the first meeting between West-Europeans and Samoyeds.

[2] The capes which bound the mouth of the Petchora—Cape Ruski Savorot and Cape Medinski Savorot,—are very nearly in lat. 69°.

[3] See above, page 168.

[4] Evidently islands near the southern extremity of Novaya Zemlya.

in our company in the riuer Cola, and also declared vnto them that we were past the way which should bring vs to the Ob. This land, sayd he, is called Nova Zembla, that is to say, the New Land; and then he came aboord himselfe with his skiffe he told me the like . . . he made me also certaine demonstrations of the way to the Ob. I gave him a steele glasse, two pewter spoons, and a paire of veluet sheathed knives; and then he seemed somewhat the more willing to tary and shewed me as much as he knew for our purpose; he also gave me 17 wild geese. . . . This man's name was Loshak. Wednesday, as we plied to Eastwards, we espied another saile, which was one of this Loshak's company, and we bare roome and spake with him, who in like sort tolde us of the Ob, as the other had done. . . . Friday (the $\frac{10\text{th Aug.}}{31\text{st July}}$) the gale of winde began to increase, and came Westerly withall, so that by a Northwest sunne we were at an anker among the Islands of Waigats, where we saw two small lodias; the one of them came aboord of us and presented me with a great loafe of bread; and they told me they were all of Colmogro, except one man that dwelt at Pechora, who seemed to be the chiefest among them in killing of the Morse.[1] There were some of their company on shoare which did chase a white beare ouer the high clifs into the water, which beare the lodia that was aboord of us killed in our sight. This day there was a great gale of wind at North, and we saw so much ice driving a seaboord that it was then no going to sea."

During the first days of August the vessel lay for the most part in company with or in the neighbourhood of Loshak, who gave them information about the Samoyeds, after which Burrough visited their sacrificial places.[2]

"Tuesday (the $\frac{14}{4}$th) August we turned for the harborough where Loshak's barke lay,[3] where, as before, we road vnder an Island. And there he came aboord of vs and said unto me: if

[1] Probably he was of Finnish race. The Quaens in North Norway are still the most skilful harpooners. In recent times they have found rivals in skill with the harpoon and gun in the Lapps.

[2] The information Burrough obtained regarding the Samoyeds is given above at page 100.

[3] From the context, and the circumstance that "much ice was drifting in the sea," we may conclude that this haven was situated on the north side of the island at the entrance to the Kara Port.

God send wind and weather to serve, I will go to the Ob with you, because the Morses were scant at these Islands of Vaigats; but if he could not get to the riuer of Ob, then he sayd hee would goe to the riuer of Narainzay,[1] where the people were not altogether so savage as the Samoyds of the Ob are: hee shewed me that they will shoot at all men to the vttermost of their power, that cannot speake their speech."

On the $\frac{15}{5}$th of August much ice was seen to drift towards the haven where the vessel lay, wherefore Burrough removed back to the place where he had lain a few days before, and whose latitude he now found to be 70° 25′. Loshak left him unexpectedly the following day, while Burrough was taking solar altitudes, and on the $\frac{19}{9}$th Burrough too weighed anchor to sail south along the coast of Vaygats. After sailing about in these waters for a time, and being exposed to a severe storm with an exceedingly heavy sea, Burrough, on the $\frac{3rd\ Sept.}{23rd\ Aug.}$, determined to turn. On the $\frac{21st}{11th}$ September he arrived at Colmogro, where he wintered with a view to continue his voyage next year to the Obi. This voyage, however, was abandoned, because he instead went westwards in order to search for two of the ships which accompanied Chancelor, and which had been lost during the return voyage from Archangel.[2]

From this narrative we see that a highly developed Russian

[1] Probably the river which on Massa's map is called Narontza, and debouches on the west coast of Yalmal.

[2] All the three vessels that were employed in the first English expedition to the North-east had an unfortunate fate, viz.:

The *Edward Bonaventure*, commanded by Chancelor and Burrough, sailed in 1553 from England to the White Sea, returned to England in 1554 and was on the way plundered by the Dutch (*Purchas*, iii. p. 250); started again with Chancelor for the Dwina in 1555, and returned the same year to England under Captain John Buckland; accompanied Burrough in 1556 to the Kola peninsula; went thence to the Dwina to convey to England Chancelor and a Russian embassy, consisting of the ambassador Ossip Gregorjevitsch Nepeja and a suite of sixteen men; the vessel besides being laden with goods to the value of 20,000*l*. It was wrecked in the neighbourhood of Aberdeen (Aberdour Bay) on the 20th (10th) November.

or Russian-Finnish navigation was carried on as early as the middle of the fifteenth century between the White Sea, the Petchora, Vaygats, and Novaya Zemlya, and that at that time the Russians or Finns even sailed to the Obi. The sketch, which Burrough gives of the Russian or Russian-Finnish hunters, shows, besides, that they were brave and skilful seamen, with vessels which for the time were very good, and even superior to the English in sailing before the wind. With very few alterations this sketch might also be applied to the present state of things in these regions, which shows that they continue to stand at a point which was then high, but is now low. Taking a general view of matters, it appears as if these lands had rather fallen behind than advanced in well-being during the last three hundred years.

To judge by a letter from the Russian Merchant Company, which was formed in London, it was at his own instance that Stephen Burrough in 1557 sailed from Colmogro, not to Obi, but to the coast of Russian Lapland to search for the lost

Chancelor himself, his wife, and seven Russians were drowned, and most of the cargo lost.

The *Bona Esperanza*, admiral of the fleet during the expedition of 1553. Its commander and whole crew perished, as has been already stated, of disease at Arzina on the coast of Kola in the beginning of 1554. The vessel was saved and was to have been used in 1556 to carry to England the Russian embassy already mentioned. After having been driven by a storm into the North Sea, it reached a harbour in the neighbourhood of Trondhjem, but after leaving that harbour disappeared completely, nothing being known of its fate.

The *Bona Confidentia* was saved like the *Bona Esperanza* after the disastrous wintering at Arzina; was also used in conveying the Russian embassy from Archangel in 1556, but stranded on the Norwegian coast, every man on board perishing and the whole cargo being lost.

Of the four vessels that left the Dwina on the 2nd August, 1556, only the *Philip and Mary* succeeded, after wintering at Trondhjem, in reaching the Thames on the 28th (18th) April, 1557. (A letter of Master Henrie Lane to the worshipfull Master William Sanderson, containing a brief discourse of that which passed in the north-east discoverie, for the space of three and thirtie yeeres, *Purchas*, iii. p. 249.)

vessels.[1] The following year the English were so occupied with their new commercial treaties with Russia and with the fitting out of Frobisher's three expeditions to the north-west, that it was long before a new attempt was made in the direction of the north-east, namely till ARTHUR PETS' voyage in 1580.[2] He was the first who penetrated from Western Europe into the Kara Sea, and thus brought the solution of the problem of the North-East Passage to the Pacific a good way forward. The principal incidents of this voyage too must therefore be briefly stated here.

PET and JACKMAN, the former in the *George*, the latter in the *William*, sailed from Harwich on the $\frac{9\text{th June}}{30\text{th May}}$, 1580. On the $\frac{2\text{nd July}}{22\text{nd June}}$ they doubled the North Cape, and on the $\frac{12\text{th}}{2\text{nd}}$ July, Pet was separated from Jackman after appointing to meet with him at "Verove Ostrove or Waygats." On the $\frac{15}{5}$th land was in sight, the latitude having the preceding day been ascertained to be 71° 38′. Pet was thus at Gooseland, on the west coast of Novaya Zemlya. He now sailed E.S.E., and fell in with ice on the $\frac{16}{6}$th July. On the $\frac{20}{10}$th July, land was seen, and the vessel anchored at an island, probably one of the many small islands in the Kara Port, where wood and water were taken on board.

On the $\frac{24}{14}$th July, Pet was in the neighbourhood of land in 70° 26′. At first he thought that the land was an island, and

[1] Hamel, *Tradescant der ältere*, p. 106. Hakluyt, 1st Edition, p. 326. *The voiage of the foresaid M. Stephen Burrough An.* 1557 *from Colmogro to Wardhouse, &c.* This voyage of Burrough has attracted little attention; from it however we learn that the Dutch even at that time carried on an extensive commerce with Russian Lapland. In the same narrative there is also a list of words with statements of prices and suitable goods for trade with the inhabitants of the Kola peninsula.

[2] Two accounts of this voyage are to be found in Hakluyt's collection (pp. 466 and 476). A copy of Pet's own journal was discovered some years ago, along with other books, frozen in among the remains of Barents' wintering on the north-east side of Novaya Zemlya. It has not been published, but is in the possession of Consul Rein at Hammerfest.

endeavoured to sail round it, but as he did not succeed in doing so, he supposed it to be Novaya Zemlya. Hence he sailed in different directions between S.W. and S.E., and was on the $\frac{26}{16}$th in 69° 40′ N.L. Next day there was lightning with showers of rain. Pet believed himself now to be in Petchora Bay, and after sighting, on the $\frac{28}{18}$th July, the headland which bounds the mouth of the river on the north-east, he sailed, it would seem, between this headland and the Selenetz Islands into the great bay east of Medinski Savorot. Here he made soundings on the supposition that the sound between Vaygats Island and the mainland would open out at this place, but the water was found to be too shallow, even for a boat. Pet now sailed past Yugor Schar along the coast of Vaygats towards Novaya Zemlya, to a bay on the west coast of Vaygats Island, where he anchored between two small islands, which were supposed to be Woronski Ostrov. *The entrance to an excellent haven was indicated on both sides by two crosses.*[1] On the islands there was abundance of driftwood, and on one of them was found a cross, at the foot of which a man was buried. Pet inscribed his name on the cross, and likewise on a stone at the foot of the cross, "in order that Jackman, if he came thither, might know that Pet had been there." In the afternoon Pet again weighed anchor, doubled the western extremity of Vaygats Island, and continued his voyage, following all along the coast of Vaygats, first to the north and north-east, then to the south, between an ice-field and the land, until the ice came so close to the shore that the vessel could make no headway, when he anchored in a good haven by an island which lay on the east side of Vaygats in the neighbourhood of the mainland. It was perhaps the island which in recent maps is called Mestni Island. Pet was thus now in the Kara Sea.[2] The latitude given—

[1] The Russians had thus landmarks on Novaya Zemlya 300 years ago.

[2] It is commonly assumed that Pet sailed into the Kara Sea through Yugor Schar, but that this was not the case is shown partly by the fact

69° 14′—shows even, if it is correct, that he went far into the bay at the mouth of the Kara river. Here Pet fell in with his comrade Jackman, from whom he had parted on the coast of Kola, and of whose voyage during the interval we know nothing. When the vessels met they were both damaged by ice. As, in addition, the sea to the north and east was barred by compact masses of ice, the captains, after deliberating with the inferior officers, determined to return. They had, also, during the return voyage, to contend with formidable ice obstacles, until, on the $\frac{25}{15}$th August, in Lat. 69° 49′ north, near the south-eastern extremity of Vaygats they met with open water. They sailed along the east coast of Vaygats through the Kara Port, which was passed on the $\frac{27}{17}$th August. Hence the course was shaped for Kolgujev Island, on whose sandbanks both vessels ran aground, but were soon got off again without loss. The latitude of the sandbanks was correctly fixed at 68° 48′.

On the $\frac{\text{1st Sept}}{\text{22nd Aug.}}$ the *William* was again lost sight of.[1] On the

that he never speaks of sailing through a long and narrow sound, partly by the account of the many islands which he saw in his voyage, and partly by the statement that coming from the south he sailed round the western-most promontory of Vaygats Island. If we except small rocks near the shore, there are no islands off the southern part of Vaygats Island. In sailing east of Medinski Savorot, Pet took the land south of Yugor Schar for Vaygats, and the soundings on the 29th (19th) July were carried out undoubtedly in the mouth of some small river debouching there.

[1] Of Jackman Hakluyt says (2nd Edition, i. p. 453): "William with Charles Jackman came to a haven in Norway between Tronden and Rostock in October, 1580, and wintered there. Thence the following February he went with a vessel, belonging to the king of Denmark, to Iceland, and since then nothing has been heard of him." About that time an English ship stranded at the Ob, and the crew were killed by the Samoyeds. It has been conjectured that it possibly was Jackman (compare *Purchas*, iii. p. 546; *Hamel*, p. 238). It is more probable that the vessel which suffered this fate was that which, two years before Pet and Jackman's voyage, appears to have been sent out by the Muscovy Company to penetrate eastwards from the Petchora. The members of this expedition were James Bassendine, James Woodcocke, and Richard Brown, but we know nothing concerning it except the very sensible

$\frac{\text{8th Sept.}}{\text{29th Aug.}}$ the *George* anchored in Tana Fiord, on which there was a town named Hungon.[1] Two days afterwards the *George* doubled the North Cape, and on the $\frac{\text{5th Nov.}}{\text{26th Oct.}}$ again anchored at Ratcliffe.

Pet and Jackman were the first north-east explorers who ventured themselves in earnest amongst the drift-ice. In navigating among ice they showed good judgment and readiness of resource, and in the history of navigation the honour falls to them of having commanded the first vessels from Western Europe that forced their way into the Kara Sea. It is therefore without justification that BARROW says of them that they were but indifferent navigators.[2]

With Pet and Jackman's voyage the English North-east Passage expeditions were broken off for a long time. But the problem was, instead, taken up with great zeal in Holland. Through the fortunate issue of the war of freedom with Spain, and the incitement to enterprise which civil freedom always brings along with it, Holland, already a great industrial and commercial state, had begun, towards the close of the sixteenth century, to develop into a maritime power of the first rank. But navigation to India and China was then rendered impossible for the Dutch, as for the English, by the supremacy of Spain and Portugal at sea, and through the endeavours of these countries to retain the sole right to the commercial routes they had discovered. In order to become sharers in the great profits which commerce with the land of silks and perfumes brought with it, it therefore appeared to be indispensable to discover a new sea route north of Asia or America to the Eastern seas.

and judicious rules that were drawn up for the expedition (*Hakluyt*, 1st Edition, p. 406).

[1] I have not been able to find any name resembling this on modern maps.

[2] *A Chronological History of Voyages into the Arctic Regions.* London, 1818, p. 99.

If such a route had been actually found, it was clear that the position of Holland would have been specially favourable for undertaking this lucrative trade. In this state of things we have to seek for the reason of the delight with which the Dutch hailed the first proposal to force a passage by sea north of Asia to China or Japan. Three successive expeditions were at great expense fitted out for this purpose. These expeditions did not, indeed, attain the intended goal—the discovery of a north-eastern sea route to Eastern Asia, but they not only gained for themselves a prominent place in the history of geographical discovery, but also repaid a hundred fold the money that had been spent on them, in part directly through the whale-fishing to which they gave rise, and which was so profitable to Holland, and in part indirectly through the elevation they gave to the self-respect and national feeling of the people. They compared the achievements of their countrymen among the ice and snow of the Polar lands to the voyage of the Argonauts, to Hannibal's passage of the Alps, and to the campaign of the Macedonians in Asia and the deserts of Libya (see, for instance, BLAVIUS. *Atlas major*, Latin edition, t. i., pp. 24 and 31.) As these voyages together present the grandest attempts to solve the problem that lay before the *Vega* expedition, I shall here give a somewhat detailed account of them.

DUTCH SKIPPER.
After G. de Veer.

THE FIRST DUTCH EXPEDITION, 1594.—This was fitted out at the expense of private persons, mainly by the merchants

BALTHASAR MUCHERON, JACOB VALCKE, and FRANCISCUS MAELSON. The first intention was to send out only two vessels with the view of forcing a passage through the sound at Vaygats towards the east, but on the famous geographer PLANCIUS representing that the route north of Novaya Zemlya was that which would lead most certainly to the desired goal, other two were fitted out, so that no fewer than four vessels went out in the year 1594 on an exploratory expedition towards the north. Of these, two, viz. a large vessel, specially equipped, it would appear, for the northern waters, called the *Mercurius*, and commanded by WILLEM BARENTS,[1] and a common fishing sloop, attempted the way past the northern extremity of Novaya Zemlya. The two others, viz. the *Swan* of Zeeland, commanded by CORNELIS CORNELISZ. NAY, and the *Mercurius* of Enkhuizen, commanded by BRANDT YSBRANDTSZ. TETGALES, were to pass through the sound at Vaygats Island.

All the four vessels left the Texel on the $\frac{15}{5}$th June, and eighteen days later arrived at Kilduin in Russian Lapland, a place where at that time vessels, bound for the White Sea, often called. Here the two divisions of the expedition parted company.

Barents sailed to Novaya Zemlya, which was reached on the $\frac{14}{4}$th July in 73° 25′; the latitude was determined by measuring the altitude of the midnight sun at an island which was called Willem's Island. Barents sailed on along the coast in a

[1] His proper name was Willem Barentszoon; it was also written Barentz, Barendsz, Bernardsson, &c. Barents' three voyages formed the subject of a work by GERRIT DE VEER, which was published for the first time in 1598 at Amsterdam in a Dutch, a Latin, and a French edition. The last-mentioned has the following title: *Vray Description de Trois Voyages des Mer très admirables faicts . . . par les navires d'Hollande & Zelande au nord . . . vers les Royaumes de China & Catay, etc.* Afterwards this work was frequently reprinted in different languages, both singly and in DE BRY'S, PURCHAS', and other collections of Travels. See on this point P. A. Tiele, *Mémoire bibliographique sur les journaux des navigateurs Néerlandais*. Amsterdam, 1867.

northerly direction, and two days afterwards reached the latitude of 75° 54′ north. On the $\frac{19}{9}$th July there was a remarkable chase of a Polar bear. The bear was fallen in with on land and was pierced by a bullet, but notwithstanding this he threw himself into the water, and swam with a vigour "that surpassed all that had been heard of the lion or other wild animal." Some of the crew pursued him in a boat, and succeeded in casting a noose round his neck in order to catch

CAPTURE OF A POLAR BEAR.
After G. de Veer.

him living, with a view to carry him to Holland. But when the bear knew that he was caught "he roared and threw himself about so violently that it can scarcely be described in words." In order to tire him they gave him a little longer line, rowing forward slowly the while, and Barents at intervals struck him with a rope. Enraged at this treatment, the bear swam to the boat, and caught it with one of his forepaws, on which Barents said: "he wishes to rest himself a little." But the

bear had another object in view, for he cast himself into the boat with such violence that half his body was soon within it. The sailors were so frightened that they rushed to the fore and thought that their last hour was come. Fortunately the bear could make no further advance, because the noose that was thrown round his neck had fastened in the rudder. A sailor taking courage, now went aft and killed the bear with the stroke of an axe. The skin was sent to Amsterdam. On account of this occurrence the place was called "Bear Cape."

Barents sailed on towards the north and north-east, past the place which he called Cruys Eylandt (Cross Island)[1] and Cape Nassau, a name which has been retained in recent maps, to the latitude of 77° 55′, which was reached on the $\frac{23\text{rd}}{13\text{th}}$ July. Here from the mast-top an ice-field was seen, which it was impossible to see beyond, which compelled Barents to turn. However, he still remained in these northern regions, waiting for a better state of the ice, till the $\frac{8\text{th August}}{29\text{th July}}$, when the vessel was due west of a promontory situated in latitude 77° north, which was named Ice Cape. Some gold-glittering stones were found here on the ground. Such *finds* have played a not inconsiderable *rôle* in the history of Arctic voyages, and shiploads of worthless ore have on several occasions been brought home. On the $\frac{10\text{th August}}{31\text{st July}}$, while sailing among the Orange Islands, they saw 200 walruses on land. The sailors attacked them with axes and lances, without killing a single walrus, but they succeeded during the attempt to kill them in striking out several tusks, which they carried home with them.

Convinced that he could not reach the intended goal by this northern route, Barents determined, after consulting with his men, to turn south and sail to Vaygats. While sailing down, Barents, in latitude 71° north, makes the remark that he was

[1] From two large crosses which were found erected on the island. This shows that the Russians had also explored the north part of Novaya Zemlya before the West-Europeans.

now probably at a place where OLIVER BRUNEL[1] had been before, and which had been named by him Costinsark, evidently

[1] The name Oliver Brunel occurs so often in accounts of the first voyages to Novaya Zemlya, and the man who bore it appears to have exercised so great an influence on the development of commercial communications with Russia, and the sending out of exploratory expeditions to the North Polar Sea, that I shall give a brief sketch of his life, mainly after S. Muller, *Geschiedenis der Noordsche Compagnie*, Utrecht, 1874, p. 26.

Oliver Brunel was born in Brussels, and in 1565 went in a Russian vessel from Kola to Kolmogor in order to learn the Russian language and make himself acquainted with the trade of the region. But the English, who of course eagerly endeavoured to prevent any intrusion on their newly-discovered commercial territory, prevailed on the Russians to keep him in prison for several years. In the end he was set at liberty, or rather handed over to the rich merchants Jakov and Grigory Anikiev (Stroganov). In consequence of this, Brunel came to take part in the commercial expeditions sent out by this mercantile house, (which by the conquest of Siberia acquired a world-historical importance, both by land and sea,) to the parts of Asia bordering on Russia, whereby he became well acquainted with the Polar Sea and the Gulf of Obi. Brunel afterwards brought about direct communication between the Netherlands and the great commercial house, almost sovereign *de facto* if not *de jure* in extensive countries. In connection with this Brunel made strenuous exertions to open in earnest the navigation of the Netherlands to the White Sea, and there found a Netherlands factory, which was placed not on Rosen Island, which was occupied by the English, but on the spot where the present Archangel is situated. Brunel next took part in preparations for a Russian North-east expedition, for which Swedish shipbuilders were received into Stroganov's service. Brunel himself travelled by land to Holland to enlist men. A number of particulars regarding these undertakings of Brunel are contained in a letter of JOHN BALAK to GERARD MERCATOR, dated "Arusburgi ad Ossellam fluvium" the 20th February, 1581. The letter is printed in the second edition of *Hakluyt*, 1598, i. p. 509. Scarcely however had Brunel returned to his native country, before he altered his plan and wished to procure for his own fatherland the honour and advantage of the undertaking. The first attempt of the Dutch to reach China and Japan by the north-east thus came about. Of this voyage we know only that Brunel endeavoured without success to sail through Yugor Schar, and that his vessel, heavily laden with furs, plates of mica, and rock-crystal, was wrecked on the way home at the mouth of the Petchora (*Beschryvinghe vander Samoyeden Landt in Tartarien, &c.* Amsterdam, 1612. S. Muller's Photolithographic Reproduction, 1878). The mica and rock-crystal were undoubtedly brought from the Ural, as no useful plates of mica or large rock-crystals are found in the region of the Petchora. Brunel then entered

the present Kostin Schar, a Russian name still in use for the sound which separates Meschduschar Island from the main island. It ought to be observed, however, that on old maps Matotschkin Schar is often marked with some perversion of the word Kostin Schar.

South of "St. Laurens Bay,"[1] in 70¾°, Barents, on the $\frac{21st}{11th}$ August, found upon a headland a cross erected, and in the neighbourhood of it three wooden buildings, the hull of a Russian vessel and several sacks of meal, and at the same place some graves, all clearly remains of some Russian salmon-fishers. On the $\frac{25}{15}$th August he arrived at Dolgoi Island, where he fell in with the two other vessels from Zeeland and Enkhuizen that had come thither shortly before. All the four vessels sailed back thence to Holland, arriving there in the middle of September. The narrative of this voyage closes with the statement that Barents brought home with him a walrus, which had been fallen in with and killed on the drift-ice. Barents during this journey discovered and explored the northern part of Novaya Zemlya, never before visited by West-European seafarers.

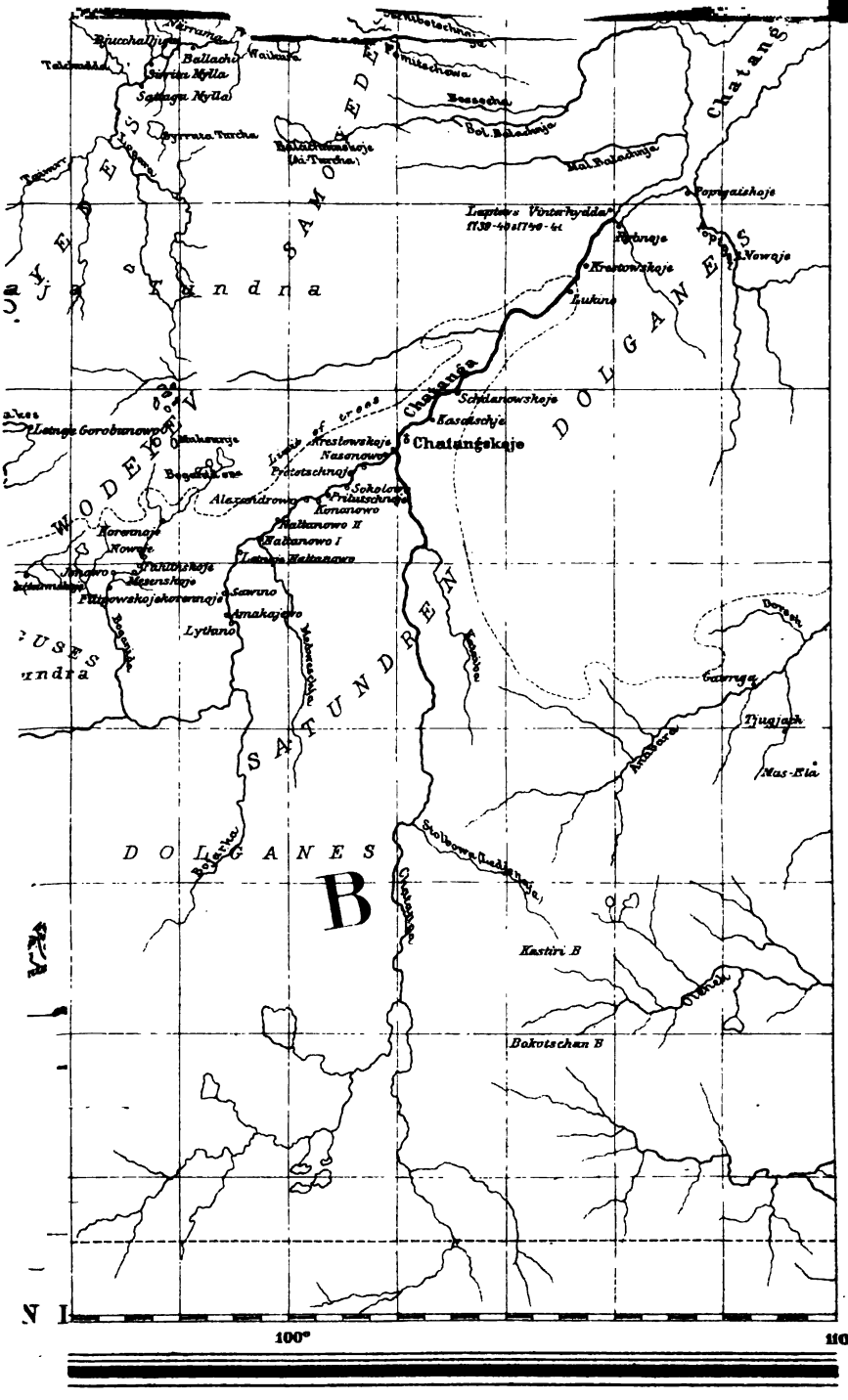
The two other vessels, that left the Texel at the same time as Barents, also made a remarkable voyage, specially sketched by the distinguished voyager JAN HUYGHEN VAN LINSCHOTEN.[2]

The vessels were manned by fifty men, among them two

the Danish service. For we know that an Oliver Brunel during the reign of King Fredrik II. in Denmark offered to explore Greenland, and for that purpose in 1583 obtained the right to settle in Bergen and there enjoy six years freedom from taxes (Cf. *Groenlands historiske Mindesmærker*, Copenhagen, 1838, vol. iii. p. 666).

[1] Probably the Sachanich Bay of the Russians.

[2] *Voyagie, ofte Schip Vaert, van Jan Huyghen van Linschoten, van by Noorden om langes Noorwegen de Noortcaep, Laplant, Vinlant, Ruslandt . . . tot voorby de revier Oby*, Franeker, 1601. Another edition at Amsterdam in 1624, and in abstract in Saeghman's collection of travels in 1665. The voyage is also described in Blavii *Atlas Major*, 1665. Linschoten was "commis" on board, a post which included both the employment of supercargo and that of owners' commissioner.



Ballachi
Sattaga Mylla
Byrrata Turcha
Bessecha
Bol. Balachnja
Mal. Balachnja
Popigaishoje
Laptews Vinterhydda
Krestowskoje
Lukino
Nowoje
Chatanga
Schdanowskoje
Kasatschje
Chatangskoje
Limit of trees
Krestowskoje
Nasonowo
Pretotschnoje
Sokolowo
Pritutschnoje
Alexandrowo
Kononowo
Haltanowo II
Haltanowo I
Letnoje Haltanowo
Sawino
Amakajewo
Lytkino
Letnoje Gorobunowo
Korennoje
Nowoje
Mesenskoje
Filipowskojekorennoje
Bogarda
Medweschja
Kataiba
Doresh
Gawriga
Tjugjach
Mas-Ela
Ambara
Stolbowa (Ledlanaja)
Chatanga
Kastiri B
Bokotschan B
Bojarka
Tundra
SAMOYEDES
DOLGANES
WODEKEV
SATUNDREN
DOLGANES
B
100°
110°

tekent, en door Isaac Massa vertaelt is.

2 BY ISAAC MASSA.

is delineated and described in considerable detail in Linschoten's work.

On the $\frac{17\text{th}}{2\text{nd}}$ July Nay and Tetgales sailed from Kilduin for Vaygats Island. Three days afterwards they fell in with much drift-ice. On the $\frac{20}{10}$th they arrived at Toxar, according to Linschoten's map an island on the Timan coast, a little west of the entrance to Petchora. They there met with a Russian *lodja* whose captain stated that he believed, after hearsay, that the Vaygats Sound [1] was continually covered with ice, and that, when it was passed, men came to a sea which lay to the south of, and was warmer than, the Polar Sea. Some other Russians added, the following day, that it was quite possible to sail through Vaygats Sound, if the whales and walruses, that destroy all vessels that seek to pass through, did not form an obstacle; that the great number of rocks and reefs scarcely permitted the passage of a vessel; and finally, that the Grand Duke had ordered three vessels to attempt the passage, but that they had all been crushed by ice.

On the $\frac{22\text{nd}}{12\text{th}}$ July there came to Toxar hunters from the White Sea, who spoke another language than the Russians, and belonged to another race of men—they were evidently Finns or Karelians. A large number of whales were seen in the haven, which gave occasion to a remark by Linschoten that whale-fishing ought to be profitable there. After the ice had broken up, and crosses with inscriptions giving information of their movements had been erected on the shore, they sailed on. On the $\frac{31}{21}$st July they sighted Vaygats. They landed at a headland marked with two crosses, and there fell in with a native, clad in much the same way as a Kilduin Lapp, who soon took to flight. Other headlands marked with crosses were afterwards visited, and places where idols were found set up by hundreds. Linschoten

[1] That is Yugor Schar. This name also occurs, though in a somewhat altered form, as "Wegorscoi tzar," on Isaac Massa's map of 1612, which, according to the statement of the publisher, is a copy of a Russian chart.

also landed on that Idol Cape which was visited during the voyage of the *Vega*. There were then from three to four hundred wooden idols, which, according to Linschoten's description, were very similar in appearance to those we saw. They were so ill made, says he, that one could scarcely guess that they were intended to represent men. The visage was very broad, the nose projecting, there were two holes in place of the eyes, and another hole represented the mouth. Five, six, or seven faces were often found carved on one and the same stock "perhaps intended to represent a whole family." Many Russian crosses were also erected there. Some days later they found on the south shore of the sound a small house filled with idols, much better made than the former, with eyes and paps of metal. While the Dutch were employed in examining this collection of idols, a reindeer sledge was driven forward in which sat a man armed with a bow. When he saw the foreigners, he called loudly, on which a number of sledges with about thirty men drove out of a valley and endeavoured to surround the Dutch. They now fled in haste to their boat, and when it had left the beach the Samoyeds shot at it with their arrows, but without hitting it. This bloodless conflict is, so far as we know, the only one that took place between the natives and the north-east voyagers. The latter are thus free from the great bloodguiltiness which attaches to most of those, who in the fifteenth and sixteenth centuries made voyages of discovery in southern regions.

Some days later, on the $\frac{\text{10th August}}{\text{31st July}}$, the Dutch had a friendly meeting with the Samoyeds, who gave them very correct information concerning the state of the land and the sea, telling them that "after ten or twelve days they would meet with no more ice, and that summer would last six or seven weeks longer." After the Dutch had learned all they could from these "barbarians, who had greater skill in managing their bow than a nautical gnomon, and could give better information regarding

their hunting than about the navigable water," they took their departure. When one of the sailors hereupon blew a horn, the savages were so frightened, that they began to take to flight, but, quieted by the assurance that the blast of the horn was only a sign of friendship, they returned and on the beach saluted the departing strangers, bowing themselves to the earth with uncovered heads and crossed hands.

On the $\frac{11\text{th}}{1\text{st}}$ August the Dutch, full of hope, sailed into the Kara Sea, or, as they called it, the "North Tartaric Ocean." They soon fell in with ice, on which account on the $\frac{13\text{th}}{3\text{rd}}$ they sought protection under Mestni Island (Staten Eiland). Here they found a sort of rock crystal resembling diamonds in all respects except hardness, a disappointing circumstance which was ascribed to the action of cold. Here also were seen images and sacrificial places, but no houses and no trees.

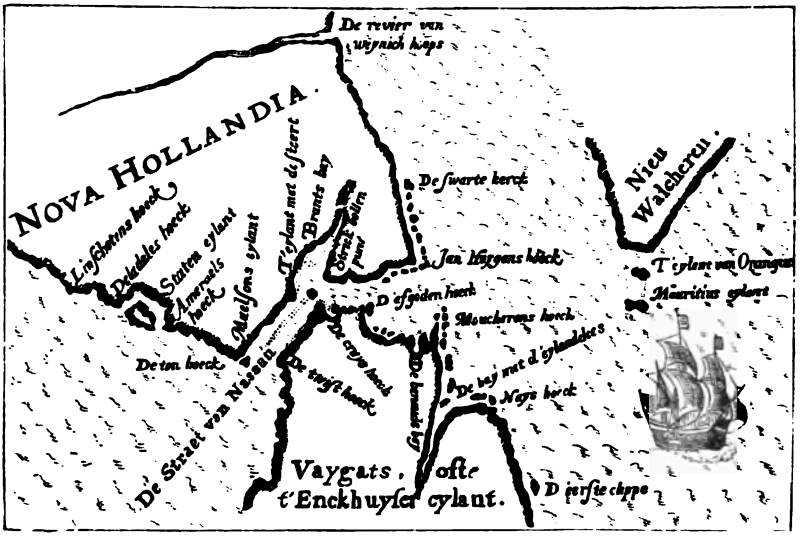
When Nay and Tetgales sailed on, they came to an extensive open sea, and on the $\frac{20}{10}$th August they believed that they were off the mouth of the Obi. Two of its principal mouth-arms they named, after the vessels, "Swan" and "Mercurius," names which have since been forgotten. It is quite evident that the river which the Dutch took for the Obi was the Kara, and that the mouth-arms, Swan and Mercurius, were two small coast rivers which debouch from Yalmal into the Kara Sea.

On the $\frac{21\text{st}}{11\text{th}}$ August they determined to return home, taking it for proved that, from the point which had been reached, it would be easy to double "Promontorium Tabin," and thus get to China by the north-east passage. A large number of whales were seen raising half their bodies out of the sea and spouting jets of water from their nostrils in the common way, which was considered a further sign that they had an extensive ocean before them.

On the $\frac{24}{14}$th August, Nay and Tetgales sailed again through Yugor Schar (Fretum Nassovicum), and the day after at three small islands, which were called Mauritius, Orange, and New Walcheren, they fell in with Barents, and all sailed

home to Holland, fully convinced that the question of the possibility of a north-east passage to China was now solved. It was shown indeed, in the following year, that this supposition rested on quite too slight a foundation, but the voyages of Nay and Tetgales deserve in any case an honoured place in the

South.



MAP OF FRETUM NASSOVICUM OR YUGOR SCHAR.
After Linschoten.

history of navigation, for they extended considerably the knowledge of the northern regions through the discovery, or at least through the first passage of, Yugor Schar, and, like Barents, these seafarers must get the credit of carrying out the task assigned to them with skill, insight, resolution, and resource.

THE SECOND DUTCH EXPEDITION, 1595.[1] After the return of the first expedition a report of the discoveries which had

[1] Accounts of this expedition are given both by De Veer and Linschoten in the above-named works.

been made was given in to Prince MAURICE of ORANGE, JAN VAN OLDENBARNEVELT, Advocate of Holland, and the other authorities at home. They were so convinced by this report that the sea route to China was actually discovered, that they immediately made arrangements to send out the following year a flotilla of seven vessels, two from Amsterdam, two from Zeeland, two from Enkhuizen, and one from Rotterdam, with a view to open the new commercial communication.

The commanders of the vessels were CORNELIS NAY (Admiral), BRANDT TETGALES (Second in Command), BARENTS, LAMBERT GERRITSZ. OOM, THOMAS WILLEMSZ., HARMAN JANSZ., and HENDRIK HARTMAN. The lieutenants were LINSCHOTEN, JACOB HEEMSKERK, FRANÇOYS DE LA DALE, JAN CORNELISZ., RIJP, and N. BUYS. Six of the vessels were laden with goods and coin; the seventh was to return home with news when the fleet had sailed through Vaygats Sound. The great preparations, however, occupied so much time that it was not until the $\frac{12\text{th}}{2\text{nd}}$ July that the voyage could be begun. On the $\frac{22\text{nd}}{12\text{th}}$ August, Kegor on the Ribatschni peninsula was sighted, and on the $\frac{29}{19}$th August the fleet arrived at the Sound between Vaygats and the mainland, and found a great deal of ice there.

On the $\frac{3\text{rd Sep.}}{24\text{th Aug.}}$ the Dutch met with some Russians, who told them that the winter had been very severe, but that the ice would in a short time disappear, and that the summer would still last six weeks. They also stated that the land to the northward, which was called Vaygats, was an island, separated on its north side from Novaya Zemlya; that it was visited in summer by natives, who towards winter returned to the mainland; that Russian vessels, laden with goods, yearly sailed through Vaygats Sound past the Obi to the river Gillissy (Yenisej), where they passed the winter; that the dwellers on the Yenisej were of the Greek-Christian religion, &c.

On the $\frac{10\text{th Sept.}}{31\text{st Aug.}}$ the Dutch came in contact with the Samoyeds south of Vaygats Sound. Their "king" received the strangers

in a very hospitable and friendly manner, and informed them that in three or four weeks the cold would begin; that in some years the drift-ice did not disappear; that during winter the whole sound and the bays and coves were frozen over, but that the sea on both sides did not freeze; that beyond the mouth of the river Ob there were the mouths of two other rivers, of which the more remote was called the "Molconsay," the nearer, which was often visited by Russian trading vessels, the Gillissy; that the land continued beyond the Ob to a cape which projected towards Novaya Zemlya, and that beyond this promontory there was a great sea, which extended along Tartary to warm regions.[1]

When the Dutch sailed into the Kara Sea they fell in with much ice, on which account they anchored at the island, Staten Eiland, where during the preceding voyage rock crystal had been found. Here two men were killed in the way that has already been described.[2] Depressed by this unfortunate occurrence and afraid to expose their vessels, laden with valuable goods, too late in the season, to the large quantity of ice which drifted about in the Kara Sea, the commanders determined to turn. The fleet returned to Holland without further adventure, passing through Vaygats Sound on the $\frac{25}{15}$th September.

This expedition did not yield any new contribution to the knowledge of our globe. But it deserves to be noted that we can state with certainty, with the knowledge we now possess of the ice-conditions of the Kara Sea, that the Dutch during both their first and second voyages had the way open to the Obi and Yenisej. If they had availed themselves of this and continued their voyage till they came to inhabited regions on either of

[1] These remarkable statements are found in Linschoten's above quoted work printed in 1601, and cannot therefore be spurious. They thus show that Taimur Land was inhabited by Samoyeds, and that the geography of this region was then well known.

[2] See above, p. 142.

these rivers, a considerable commerce would certainly have arisen between Middle Asia and Europe by this route as early as the beginning of the seventeenth century.

THE THIRD DUTCH EXPEDITION, 1596–97.[1] After the unfortunate issue of the expedition of 1595, which had been fitted out at so great an expense, and which had raised so

UNSUCCESSFUL FIGHT WITH A POLAR BEAR,
During the Second Dutch Expedition. From De Veer.

great expectations, the States-General would not grant the necessary funds for a third voyage, but they offered instead a great prize to the states or merchants that at their own expense should send out a vessel that should by the route north

[1] The sketch of this voyage forms the main portion of the above mentioned work of De Veer. Undoubtedly the adventures during the wintering, the first in so high a latitude, in the first place procured for De Veer's work the enormous popularity it enjoyed, and led to its being translated into so many languages.

of Asia force a passage to Asia and China.[1] Encouraged by this offer the merchants of Amsterdam sent out two vessels, one under the command of Willem Barents and Jacob van Heemskerk, the other under Jan Cornelisz. Rijp. The crew were chosen with care, unmarried men being preferred, with the idea that wife and children would detract from the bravery of the members of the expedition and lead them to return home prematurely.

On the $\frac{20}{10}$th May these vessels left Amsterdam. On the $\frac{14}{4}$th June they saw in lat. 71° North some beautiful parhelia, which are found delineated in De Veer's work, and Blavii *Atlas Major*.

On the $\frac{15}{5}$th June one of the crew cried out from the deck that he saw white swans, but on a closer examination it appeared that they consisted of large pieces of ice, which drifted along

[1] The resolution regarding the offer of this prize is given below:

Extract uit het Register der Resolutien van de Hoog Mogende Heeren Staten Generael der Vereenigde Nederlanden.

Folio 158 v^eo 13 April 1596.

De Gedeputeerde van de Heeren Staten van Holland verclaren dat heure principalen geadviseert hebbende op de hervattinge van het voyagie naer China en Japan, benoorden om, deselve voyage afgeslagen hebben, ten aenzien van de groote costen die nu twee Jaren achter den anderen om de reyse te verzoeken te vorgeefs angewent zijn, maer dat Hare E. goetgevonden ende geconsenteert hebben, mede tgevolgh van de andere provincien bij zoeverre datter eenige coopluijden aventuriers bij compagnie ofte anderssine de voerscreven reijse op heure costen ende risique, zonder te schepen ende tgelt van den lande, zonde begeren te verzoeken, dat men dezelve aventuriers de reijse gevonden ende gedaen hebbende, daervan brengende goet ende gelooffijck beschijt, tot haer luijder wedercomste, zal vereeren mette somme van vijff en twintich duysent gulden eens. Item daar enboven accorderen den vrijdom voor twee jaren van convoyen der goederen die zij uit dese landen naer China off Japan zullen transporteren, ende noch vrijdom voer den tyd van acht jaren van te goederen die zij uit China ofte Japan in dese landen sullen bringen. Waerop geadviseert wesende hebben de Gedeputeerde van d'andere provincien hen daarmede geconformeert, die van Seelant opt welbehagen van heure principalen, maer die van Utrecht hebben verclart niet te consenteren in de vereeringe van XXV^M £.

ISLAND
MARE SEPTENTRIONA
Norvegia
PARS
EUROPA
Scotia
Orcades Insulæ
Hitland
Dania
Bergen
Aberdeen
Newcastle
Scarborgh
Hartlepole

J. I. PONTAN

the edge of the pack.[1] On the $\frac{19}{9}$th they discovered, north of North Cape, a new island, situated in latitude 74° 30′ North. A large bear was killed here, and on this account the island was called Bear Island. On the $\frac{29}{19}$th they came in the 80th degree of latitude to another formerly unknown land, which they believed to be connected with Greenland. It was in fact the large group of islands, which afterwards obtained the name Spitzbergen. There were found here on a small island the eggs of a species of goose—*rotgansen*,[2] which comes yearly to Holland in great flocks, but whose breeding place was before unknown. With reference to this, De Veer says that it is finally proved that this goose is not, as has been hitherto supposed, propagated in Scotland by the goose laying her eggs from the branches of trees overhanging the water, the eggs being broken in pieces against the surface of the water, and the newly hatched young immediately swimming about.

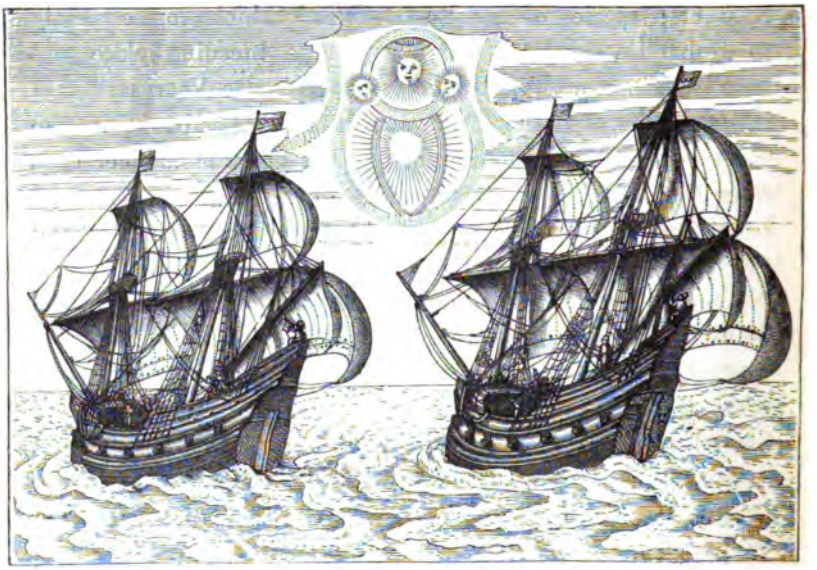
After an unsuccessful attempt had been made to sail to the north of Spitzbergen the vessels proceeded southwards along the west coast,[3] and on the $\frac{11\text{th}}{1\text{st}}$ July came again to Bear Island. Here the vessels parted company, Barents sailing eastwards towards Novaya Zemlya, Rijp northwards towards the east coast of Spitzbergen. On the $\frac{27}{17}$th July, Barents reached the west coast of Novaya Zemlya in latitude 73° 20′ North. On

[1] Every Polar traveller has at one time or other made the same or a similar mistake. In 1861, for instance, a boat party, of whom I was one, thought that they saw clearly sailors in sou'-westers and with white shirt-sleeves building a cairn on a point which appeared to be at no great distance. But the cairn was found to be a very distant mountain, the shirt-sleeves were formed of snow-fields, the sou'-westers of pointed cliffs, and the motion arose from oscillatory changes in the atmospheric strata.

[2] Undoubtedly *Anser bernicla*, which is common on the west coast of Spitzbergen. The Dutch name ought neither to be translated *red goose*, as some Englishmen have done, nor confounded with *rotges*.

[3] See the copy of Barents' own map with his course laid down upon it, which is to be found in Pontanus, *Rerum et urbis Amstelodamensium Historia* (Amst. 1611), and is annexed to this work in photolithographic facsimile.

the $\frac{30}{20}$th July, no further advance could be made for ice, which still lay close to the shore. During the stay here there were several adventures with bears, all of which came off successfully. In consequence of ice obstacles their progress was exceedingly slow, so that it was not until the $\frac{25}{15}$th August that they reached the Orange Islands. The following day several of the crew ascended a high mountain, from which they saw open water



BARENTS' AND RIJP'S VESSELS.
From De Veer.

on the other side of an island. As glad at the sight of the sea as the ten thousand under Xenophon, they rushed back to the vessel to give Barents the important news. He now did all he could to pass the north extremity of Novaya Zemlya. He was successful in doing so, and on the $\frac{31}{21}$st a haven, situated in about the latitude of 76° North, was reached with great difficulty, but all attempts to sail eastwards from it were

unsuccessful. Finally, on the $\frac{4\text{th Sept.}}{26\text{th Aug.}}$ Barents determined to return to Holland.

Now, however, it was too late. The haven was blocked with drift-ice, which was in constant motion, several times pressed the vessel high up between the pieces of ice, and finally broke the rudder in pieces. It was now evident that it would be necessary to winter, and for this purpose the requisite tools, household articles, and provisions were landed and men sent out to examine the neighbourhood. Reindeer tracks were seen, and, what was more important, there were found on the beach large tree-stems with their roots still adhering, and other wood which the marine currents had drifted to this otherwise completely woodless region. The drift-wood was collected in large heaps that it might not be buried under the snow in winter. A place was chosen for a house, and the Dutch began to draw timber to the place. The openings in the drift-ice were on the $\frac{25}{15}$th September covered with a crust of ice two inches thick, but on the $\frac{5\text{th Oct.}}{25\text{th Sept.}}$ the ice was again somewhat broken up, which however was of no advantage to the imprisoned, because their vessel was forced up so high on a block of ground ice that it could not be got off. Bears were hunted almost daily. They were very bold and sometimes came on board the vessel. On the $\frac{15}{5}$th October all ice was driven off as far as the eye could see, but the vessel still lay motionless on the blocks of ground ice. Round these the ice closed in again, to break up anew at a greater or less distance from the beach. On the $\frac{4\text{th March}}{22\text{nd Feb.}}$ there was still much open water visible from the beach, and on the $\frac{16}{6}$th and $\frac{18}{8}$th March, the sea appears to have been in one direction completely free of ice.

On the $\frac{31}{21}$st October, the crew began to remove into the house, where they afterwards passed the winter 1596–97 with many sufferings, dangers, difficulties, and privations which are described in De Veer's work. The crew, however, never lost courage, which undoubtedly was a principal cause of most of

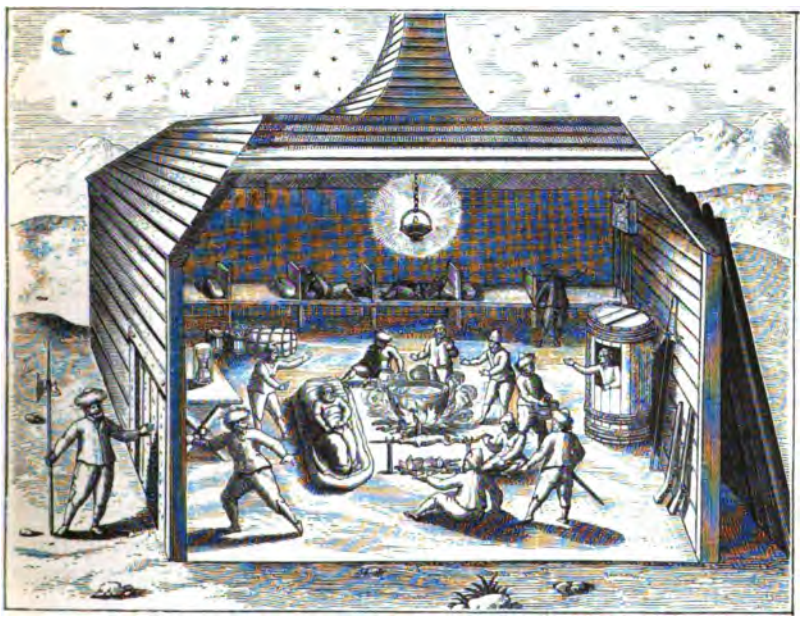
them being saved. The house was built on the north-east side of Novaya Zemlya, on the shore of Barents' Ice Haven. It was situated far to the north of any other place where men had previously passed the winter. The land and its animal life was unknown, the hard frozen, almost rock-fast and yet continually moving ice-covering, with which the sea was bound, was something quite novel, as also were the effects which long continued and severe cold exerts on animate and inaminate

BARENTS' HOUSE, OUTSIDE.
From De Veer.

objects. Before the attempt was made it was not considered at all certain that men could actually endure the severe cold of the highest north and the winter night three or four months long. No wonder therefore that the skill and undaunted resolution of the Dutch Polar explorers aroused unmingled admiration among all civilised nations, and that the narrative of their wintering was received with unbounded interest and

formed the subject of innumerable writings and reproductions both in prose and verse in almost all civilised languages. Only a few facts from the journal of the wintering need therefore be given here.

On the $\frac{11}{4}$th November the sun disappeared, and was again visible on the $\frac{\text{3rd Feb.}}{\text{24th Jan.}}$. These dates have caused scientific men



BARENTS' HOUSE, INSIDE.
From De Bry.

much perplexity, because in latitude 76° North, the upper edge of the sun ought to have ceased to be visible when the sun's south declination in autumn became greater than 13°,[1] and to have again become visible when the declination again became less than that figure; that is so say, the sun ought to have

[1] On the assumption of a horizontal refraction of about 45'.

been seen for the last time at Barents' Ice Haven on the $\frac{27}{17}$th October, and it ought to have appeared again there on the $\frac{14}{4}$th February. It has been supposed that the deviation arose from some considerable error in counting the days, but this was unanimously denied by the crew who wintered.[1] The bears disappeared and reappeared with the sun. Instead, foxes came during winter to the building, and were caught for food in numbers, many on the roof of the house. In order to pass the time and keep up their courage, the Dutch sometimes had entertainments, at which the cheerfulness of the partakers had to make up for the meagreness of the fare. After the return of the sun the bears again came very close, so that there was a number of hunting adventures with them, all of which came off successfully. Several bears made themselves at home in the vessel abandoned by the crew, casting everything about, and broke up the hatch of the kitchen, covered as it was with deep snow. An attempt to eat bear's liver resulted in those that ate of it becoming very ill, and after recovery renewing their skin over the whole body. Once during severe cold, when pitcoal was used to warm the building, all the men in it were like to have died of the fumes. On one or two occasions, for instance on the $\frac{25}{15}$th February, so much snow had collected outside the door, that it was necessary to go out by the chimney. For the preservation of their health the Dutch often took a vapour bath in a barrel fitted up for the purpose.

On the $\frac{7\text{th May}}{27\text{ th April}}$ the first small birds were seen, and on the $\frac{26}{15}$th

[1] See on this point De Veer, leaf 25 and an unpaged leaf between pages 30 and 31 in Blavii *Atlas Major*, tom. i. That a mistake occurred in the date is not possible, because the latitude was determined by solar observations on the 29th (19th) February, the 21st (11th) and 31st (21st) March (see De Veer, l. 27). Besides, at the correct date, the 3rd February (24th January), a conjunction of Jupiter and the moon was observed, whereby the difference of longitude between Ice Haven and Venice was determined to be 75°. However erroneous this determination may be, it shows, however, that the date was correct.

May Barents declared that if the vessel were not got off before the end of the month, they should return in boats, which were therefore immediately got ready. This was, however, attended with great difficulty, because most of the crew had during the course of the winter become exceedingly weak, evidently from scurvy. After the equipment of the boats had been completed and they had been properly laden with provisions, the Dutch at last started on the $\frac{23\text{rd}}{13\text{th}}$ June.

A man had died on the $\frac{6\text{th Feb.}}{27\text{th Jan.}}$. At the beginning of the boat voyage Barents himself was very ill, and six days after, on the $\frac{30}{20}$th June, he died, while resting with his companions on a large floe, being compelled to do so by the drift-ice. On the same day one of the crew died, and on the $\frac{15}{5}$th July another.

On the $\frac{7\text{th Aug.}}{28\text{th July}}$ the returning Arctic explorers at St. Lawrens' Bay fell in with two vessels manned by Russian hunters, whose acquaintance the Dutchmen had made the year before, and who now received them with great friendliness and pity for their sufferings. They continued their voyage in their small open boats, and all arrived in good health and spirits at Kola, where they were received with festivities by the inhabitants. It gave them still greater joy to meet here Jan Cornelisz. Rijp, from whom they had parted at Bear Island the preceding year, and of whose voyage we know only that he intended to sail up along the east coast of Spitzbergen, and that, when this was found to be impossible, he returned home the same autumn.

After the two boats, in which Barents' companions had travelled with so many dangers and difficulties from their winter haven to Russian Lapland, had been left in the merchant's yard[1] at Kola, as a memorial of the journey—the first memorial of

[1] Built along with a weigh-house intended for the Norwegians in 1582 by the first vojvode in Kola (*Hamel*, p. 66). In Pontanus (*Rerum et urbis Amstelodamensium Historia*, Amsterodami, 1611, p. 142), there is a drawing of the inner yard of this house, and of the reception of shipwrecked men there.

a Polar expedition was thus raised at Kola!—they went on board Rijp's vessel, and sailed in it to Holland, arriving there the $\frac{\text{8th November.}}{\text{29th October.}}$. Sixteen men had left Holland with Barents, twelve men returned in safety to their native land, and among them JACOB VAN HEEMSKERK, a man who during the whole

JACOB VAN HEEMSKERK,
Born in 1567 at Amsterdam, died in 1607 at Gibraltar.
After a contemporary engraving by N. de Clerck.

voyage had played a prominent part, and afterwards lived long enough to see the time when the Dutch were a match at sea for the Spaniards. For he fell as commander of the Dutch fleet which defeated the Spanish at Gibraltar on April 25, 1607.

During Barents' third voyage Bear Island and Spitzbergen were discovered, and the natural conditions of the high northern regions during winter first became known. On the other hand, the unfortunate issue of the maritime expeditions sent out from Holland appears to have completely deterred from further attempts to find a north-eastern commercial route to China and Japan, and this route was also now less necessary, as Houtman returned with the first Dutch fleet from the East Indies the same year that Barents' companions came back from their wintering. The problem was therefore seriously taken up anew for the first time during the present century; though during the intervening period attempts to solve it were not wholly wanting.

For the desire to extend the White Sea trade to Siberia, and jealousy of the companies that had known how to procure for themselves a monopoly of the lucrative commerce with eastern Asia, still led various merchants now and then during the seventeenth century to send out vessels to try whether it was possible to penetrate beyond Novaya Zemlya. I shall confine myself here to an enumeration of the most important of these undertakings, with the necessary bibliographical references.

1608. HENRY HUDSON, during his second voyage, landed on Novaya Zemlya at Karmakul Bay and other places, but did not succeed in his attempt to sail further to the east, north of this island. He made the voyage on account of English merchants. A narrative of it is to be found in *Purchas* (iii. p. 574), and an excellent critical collection of all the original documents relating to Hudson's life and voyages in G. M. Asher's *Henry Hudson the Navigator*, London, 1860 (Works issued by the Hakluyt Society, No. 26). It was west of the Atlantic that Hudson earned the laurels which gave him for all time so prominent a place in the history of navigation, and the sea there also became his grave. Eastwards he did not penetrate

so far as his predecessors. I cannot therefore here find room for any account of his voyage to Novaya Zemlya; it may only be mentioned that two of his crew on the morning of the $\frac{25}{15}$th of June, 1608, in 75° N.L., saw a mermaid. The following statement is taken from his journal: "This morning one of the crew, as he looked over the side, saw a mermaid. Another of his comrades came up at his call. She was close to the vessel's side, looking steadily at the men. Soon after she was thrown down by a wave. From the middle upwards her back and breast were like a woman's. Her body was as large as a man's, her skin very white, and long dark hair hung down her back. When she dived, they saw her tail, which resembled that of a dolphin and was spotted like a mackerel's. The names of the men who saw her were Thomas Hiller and Robert Rayner." It was probably a curious seal that gave occasion to this version of the old yarn.

1611. WILLIAM GOURDON, with the title "appointed chief pilote for discoverie to Ob," brought this year a cargo of goods to Pustosersk, and sailed thence to Novaya Zemlya. At the mouth of the Petchora he saw 24 *lodjas*, manned with ten to 16 men each, bound for "Mangansei" east of Ob (*Purchas*, iii. pp. 530, 534). While attempting to get further information regarding these voyages to Siberia, the Muscovy Company's envoy learned that, at least as a rule, the question was only of carrying goods by sea to the bottom of Kara Bay, whence they were transported overland to Ob, advantage being taken of two small rivers and a lake (*Purchas*, iii. p. 539). But other accounts lead us to infer that the Russian *lodjas* actually sailed to Ob, even through Matotschkin Schar, as appears from statements in *Purchas* (iii. pp. 804, 805). At the same place we find the statement, already quoted, of a Russian, who in 1584 offered for fifty roubles to act as guide overland from the Petchora to the Ob, that a West-European ship was wrecked at the mouth of the Ob, and its crew killed by the Samoyeds

who lived there. The Russian also said that it was an easy matter to sail from Vaygats to the mouth of the Ob.

1612. The whaling captain JAN CORNELISZ. VAN HOORN endeavoured to sail north of Novaya Zemlya towards the east, but met with ice in 77° N.L., which compelled him to return (*Witsen*, p. 906).

1625. CORNELIS BOSMAN, at the instance of the Northern Company of the Netherlands, with a vessel of 90 tons, manned by 24 men, and provisioned for two and a half years, passed through Yugor Schar eastwards, but fell in with so much ice in the Kara Sea that he was compelled to seek for a harbour in that sound. There he waited for more favourable conditions, but was finally compelled by storm and ice to return with his object unaccomplished. (S. Müller, *Geschiedenis der Noordsche Compagnie*, Utrecht, 1874, p. 185.)

1653.[1] This year a Danish expedition was sent out to the North-east. An account of the voyage was given by DE LA MARTINIÈRE, surgeon to the expedition, in a work published for the first time at Paris in 1671, with the following title: *Voyage des Pais Septentrionaux. Dans lequel se void les mœurs, manière de vivre, & superstitions des Norweguiens, Lappons, Kiloppes, Borandiens, Syberiens, Samojedes, Zembliens, & Islandois, enrichi de plusieurs figures.*[2] This work afterwards attained a considerable circulation, doubtless in consequence of Martinière's easy style, contrasting so strongly with the common dry ship's-log manner, and the large number of wonderful stories he narrates, without

[1] The year is incorrectly given as 1647 by F. von Adelung (*Kritisch-Litterärische Uebersicht*, &c.).

[2] The following editions are enumerated: four French, Paris, 1671, 1672, 1676, and Amsterdam, 1708; six German, Hamburg, 1675, Leipzig, 1703, 1706, 1710, 1711, and 1718; one Latin, Glückstadt, 1675; two Dutch, Amsterdam, 1681 and 1685; one Italian, printed in Conte Aurelio degli Anzi's *Il Genio Vagante*, Parma, 1691; two English, one printed separately in 1706, the other in Harris, *Navigantium atque Itinerantium Bibl.*, 3rd edition. London, 1744-48, Vol. II. p. 457.

the least regard to truth or probability. He is the Münchhausen of the North-east voyages. The Norse peasants, for instance, are said to be all slaves to the nobles, who have sovereign power over their property, tyrannise over their inferiors, and are prone to insurrection. The elks are said to be liable to falling sickness, and therefore fall down in convulsions when they are hunted—hence their name "eleend." Sailors are said to have purchased on the north-west coast of Norway for ten crowns and a pound of tobacco three knots of wind from the Lapps living there, who were all magicians; when the first knot was loosed, a gentle breeze arose, the second gave a strong gale, the third a storm, during which the vessel was in danger of being wrecked.[1] Novaya Zemlya is stated to be inhabited by a peculiar tribe, "the Zembliens," of whom two were taken prisoners and carried to Copenhagen. De la Martinière also got the head of a walrus, which had been harpooned with great difficulty; the animal was drawn as a fish with a long horn projecting from its head. As a specimen of the birds of Novaya Zemlya a penguin was drawn and described, and finally the work closed with a rectification of the map of the Polar Regions, which according to the author's ideas ought to be as represented below. I refer to these absurdities, because the account of Martinière's voyage exerted no little influence on the older writings relating to the Arctic Regions.

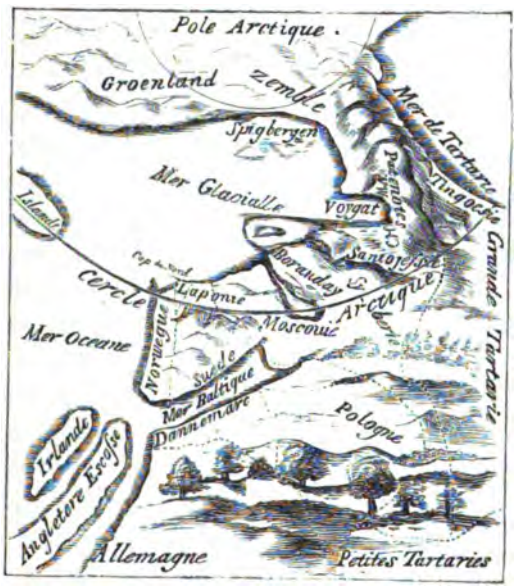
1664 and 1668. A whaling captain, WILLEM DE VLAMINGH, sailed in 1664 round the northern extremity of Novaya Zemlya to Barents' winter quarters, and thence eastwards, where one of his men thought he saw land ("Jelmert-landt," *Witsen*, p. 902).[2] The same Vlamingh says that in 1668 he discovered, twenty-five miles N.N.E. of Kolgujev, a new island three to four

[1] The story of the wind knots is taken from Olaus Magnus, *De gentibus septentrionalibus*, Rome, 1555, p. 119. There a drawing of the appearance of the knots is also given.

[2] Compare page 203.

miles in circumference. This island, which was described in great detail, and named by the discoverer "Witsen's Island," has not since been seen again (*Witsen*, p. 923).

1666. In this year some vessels were sent from the Netherlands to the north-east. There were Jews among the owners, and the seafarers were furnished with letters in Hebrew, because it was believed that they would come in contact with some of



DE LA MARTINIÈRE'S MAP.

the lost tribes of Israel. Nothing further appears to have been known of the voyage, which undoubtedly was without result. (*Witsen*, p. 962.)

1675. A Dutch whaling captain, CORNELIS PIERSZ. SNOBBERGER, visited Novaya Zemlya, on whose coast he killed three whales and six hundred walruses. He would probably have got still more "fish," if he had not in 72½° found an ore, which

appeared to contain silver, gold, and other metals. Instead of blubber the skipper now loaded ore, which in his opinion was precious, but afterwards on being tested at home was found to be valueless (*Witsen*, p. 918).

17th Century, year not stated. Shipmaster CORNELIS ROULE is said to have sailed in the longitude of Novaya Zemlya to 84½° or 85° N.L. and there discovered a fjord-land, along which he sailed ten miles. Beyond that a large open sea was seen. From a high mountain situated on a sound, in which he rode, it appeared that he might sail one or two watches further to the north. He found there large numbers of birds, which were exceedingly tame (*Witsen*, p. 920). If we take some degrees from the latitude stated, which is perhaps not very unreasonable in dealing with the narratives of old whalers, which have passed through two or three hands, Roule may, as far back as two hundred years ago, have reached Franz-Josef's Land, and sailed along its coast to a very high latitude for those regions.

1676. WOOD and FLAWES were sent out from England by Charles II. to sail by the north-east passage to the Pacific. For this purpose the English Admiralty fitted out a vessel, the *Speedwell*, while "as all exploratory voyages are exposed to the possibility of disaster," another small ship, the *Prosperous*, was purchased and handed over to the expedition by private gentlemen.[1] The command of the first vessel was given to Captain Wood, the chief promoter of the undertaking, and the other vessel was commanded by Captain Flawes. The voyage was completely without result, as Wood did not penetrate so far, either to the north or east, as his predecessors or as the whalers, who appear to have at that time frequently visited North Novaya Zemlya. Wood had previously accompanied Sir

[1] These were James Duke of York, Lord Berkley, Sir John Williamson, Sir John Bankes, Mr. Samuel Peeps, Captain Herbert, Mr. Dupey, and Mr. Hoopgood (Harris, *Nav. Bibl.*, vol. ii. p. 453).

John Narborough during a voyage through the dangerous Magellan Straits, in the course of which he became known as a bold and skilful seaman, but he not only wanted experience in sailing amongst ice, but also the endurance and the coolness that are required for voyages in the high north. He thereby showed himself to be quite unfit for the command which he undertook. Before his departure he was unreasonably certain of success; with the first encounter with ice his self-reliance gave way entirely; and when his vessel was wrecked on the coast of Novaya Zemlya, he knew no other way to keep up the courage of his men and prevent mutiny than to send the brandy bottle round.[1] Finally after his return he made Barents and other distinguished seafarers in the Arctic Regions answerable for all the skipper tales collected from quite other quarters, which he before his departure held to be proved undoubtedly true. This voyage would therefore not have been referred to here, if it had not been preceded and followed by lively discussions regarding the fitness of the Polar Sea for navigation, during which at least a portion of the experience which Dutch and English whalers had gained of the state of the ice between Greenland and Novaya Zemlya was rescued from oblivion, though unfortunately almost exclusively in the form of unconfirmed statements of very high latitudes, which had been occasionally reached. Three papers mainly led to Wood's voyage. These were :—

1. A letter, inserted in the Transactions of the Royal Society,[2] on the state of Novaya Zemlya, said to be founded on discoveries which had been made at the express command of the Czar.

[1] "All I could do in this exigency was to let the brandy-bottle go round, which kept them allways fox'd, till the 8th July Captain Flawes came so seasonably to our relief" (Barrow, *A Chronological History of Voyages into the Arctic Regions.* London, 1818, p. 268).

[2] "A letter, not long since written to the Publisher by an Experienced person residing at Amsterdam," etc. (*Philosophical Transactions*, vol. ix. p. 3. London, 1674).

The letter was accompanied by a map, drawn by an artist named Panelapoetski, who sent it from Moscow as a present to the writer. The Kara Sea is said to be a freshwater inland lake which freezes strongly in winter, and it is stated that according to the unanimous accounts of the Samoyeds and Tartars it is quite possible to sail north of Novaya Zemlya to Japan.

2. Another letter was inserted in the *Transactions* of the Royal Society,[1] in which the statement in the former letter on the connection of Novaya Zemlya with the mainland is repeated, and the difficulties which Barents met with ascribed to the circumstance that he sailed too near the land, along which the sea is often frozen; some miles from the shore, on the other hand, it never freezes, even at the Pole, unless occasionally. It is also said that some Amsterdam merchants sailed more than a hundred leagues eastward of Novaya Zemlya, and on that account petitioned the States-General for privileges.[2] However, in consequence of opposition from the Dutch East

[1] "A summary Relation of what hath been hitherto discovered in the matter of the North-East passage; communicated by a good Hand" (*Phil. Trans.*, vol. x. p. 417. London, 1675).

[2] The time when the voyage was made is not stated in the letter quoted. Harris says that he with great difficulty ascertained the year of the successful voyage to the eastward to be 1670. He says further that the persons who gave him this information also stated that, at the time when this petition was given in to the States-General, it was also asserted that there was no difficulty in sailing northwards from Spitzbergen (Greenland), and that many Dutch vessels had actually done it. To confirm this statement the merchants proposed that the logs of the Spitzbergen fleet for the year 1655 should be examined. This was done. In seven of them it was found recorded that the vessels had sailed to 79° N. L. Three other logs agreed in the point that on the 1st August, 1655, 88° 56′ *was observed.* The sea here was open and the swell heavy (Harris, *Nav. Bibl.*, ii. p. 453). J. R. Forster (*Geschichte der Entdeckungen und Schiffahrten im Norden*, Frankfurt a. d. Oder, 1874) appears to place the voyage eastward of Novaya Zemlya in the period before 1614. It is, however, probable that the voyage in question is Vlamingh's remarkable one in 1664, or that in 1666, of which I have already given an account.

India Company, their petition was not granted, on which the merchants turned to Denmark. Here their proposal was immediately received with favour. Two vessels were fitted out, but instead of sailing to Japan, they went to Spitzbergen to the whale-fishing. It is further stated in the letter that it would not be unadvisable to let some persons live for a time with the Samoyeds, in order to find out what they knew of the matter, and that, when a more complete knowledge of the navigable waters was acquired, the whole voyage from England to Japan might be accomplished in five or six weeks. Were a wintering necessary, it would not be attended with any danger, if, instead of a house of thick planks standing by itself, earth huts were used.

3. A pamphlet, whose contents are given in the long and peculiar title: "A brief Discourse of a Passage by the North-Pole to Japan, China, etc. Pleaded by Three Experiments: and Answers to all Objections that can be urged against a Passage that way. As: 1. By a Navigation from Amsterdam into the North-Pole, and two Degrees beyond it. 2. By a Navigation from Japan towards the North-Pole. 3. By an Experiment made by the Czar of Muscovy, whereby it appears, that to the Northwards of Nova Zembla is a free and open Sea as far as Japan, China, etc. With a Map of all the Discovered Lands neerest to the Pole. By Joseph Moxon, Hydrographer to the King's most Exellent Majesty. London, 1674."

The most remarkable passage in this scarce little book is the following:—

"Being about twenty-two years ago in Amsterdam, I went into a drinking-house to drink a cup of beer for my thirst, and sitting by the public fire, among several people, there happened a seaman to come in, who, seeing a friend of his there, whom he knew went in the Greenland voyage, wondered to see him, because it was not yet time for the Greenland fleet to come home, and asked him what accident brought him home so soon; his friend (who was the steer-man aforsaid in a

Greenland ship that summer) told him, that their ship went not out to fish that summer, but only to take in the lading of the whole fleet, to bring it to an early market. But, said he, before the fleet had caught fish enough to lade us, we, by order of the Greenland Company, sailed unto the north pole and back again. Whereupon (his relation being novel to me) I entered into discourse with him, and seemed to question the truth of what he said; but he did ensure me it was true, and that the ship was then in Amsterdam, and many of the seamen belonging to her to justify the truth of it; and told me, moreover, that they had sailed two degrees beyond the pole. I asked him if they found no land or islands about the pole? He told me, No, they saw no ice; I asked him what weather they had there? He told me fine warm weather, such as was at Amsterdam in the summer time and as hot." [1]

In addition to these stories there were several contributions to a solution of the problem, which Wood himself collected, as a statement by Captain Goulden, who had made thirty voyages to Spitzbergen, that two Dutchmen had penetrated eastward of that group of islands to 89° N.L.; the observation that on the coast of Corea whales had been caught with European harpoons in them; [2] and that driftwood eaten to the heart

[1] In more recent times the whalers have been more modest in their statements about high northern latitudes reached. Thus a Dutchman who had gone whale-fishing for twenty-two years, at an accidental meeting with Tschitschagoff in Bell Sound in the year 1766, stated among other things that he himself had once been in 81°, but that he heard that other whalers had been in 83° and had seen land over the ice. He had seen the east coast of Greenland (Spitzbergen) only once in 75° N. L. (Herrn von Tschitschagoff Russisch-kaiserlichen Admirals *Reise nach dem Eissmeer*, St. Petersburg, 1793, p. 83). Dutch shipmasters too, who in the beginning of the seventeenth century penetrated north of Spitzbergen to 82°, said that they had thence seen land towards the north (Müller, *Geschiedenis der Noordsche Compagnie*. p. 180).

[2] Witsen states, p. 43, that he had conversed with a Dutch seaman, Benedictus Klerk, who had formerly served on board a whaler, and afterwards been a prisoner in Corea. He had asserted that in whales that were killed on the coast of that country he had found Dutch harpoons. The Dutch then carried on whale-fishing only in the north part of the Atlantic. The *find* thus shows that whales can swim from one ocean to the other.

by the sea-worm was found on the coasts of the Polar lands, &c.[1]

When Wood failed, he abandoned the views he had before maintained, declaring that the statements on which he had founded his plans were downright lies and delusions. But the belief in a polar sea that is occasionally navigable is not yet given up. It has since then been maintained by such men as DAINES BARRINGTON,[2] FERDINAND VON WRANGEL, AUGUSTUS PETERMANN,[3] and others. Along with nearly all Polar travellers of the present day, I had long been of an opposite opinion, believing the Polar Sea to be constantly covered with impenetrable masses of ice, continuous or broken up, but I have come to entertain other views since in the course of two winterings—the first in 79°53′, that is to say, nearer the Pole than any other has wintered in the old world, the second in the neighbourhood of the Asiatic Pole of cold—I have seen that the sea does not freeze completely, even in the immediate

As we know that these colossal inhabitants of the Polar Sea do not swim from one ice-ocean to the other across the equator, this observation must be considered very important, especially at a time when the question whether Asia and America are connected across the Pole was yet unsettled. Witsen also enumerates, at p. 900, several occasions on which stone harpoons were found in the skins of whales caught in the North Atlantic. These harpoons, however, may as well be derived from the wild races, unacquainted with iron, at Davis Strait, as from tribes living on the north part of the Pacific. At Kamschatka, too, long before whale-fishing by Europeans began in Behring's Sea, harpoons marked with Latin letters were found in whales (Steller, *Beschreibung von dem Lande Kamtschatka*, Frankfurt und Leipzig, 1774, p. 102).

[1] The account of Wood's voyage was printed in London in 1694 by Smith and Walford, printers to the Royal Society (according to a statement by Barrington, *The possibility of approaching the North Pole asserted*, 2nd Edition, London, 1818, p. 34). I have only had an opportunity of seeing extracts from the account of this voyage in *Harris* and others

[2] Barrington published a number of papers on this question, which are collected in the work whose title is given above, of which there were two editions.

[3] At several places in his *Mittheilungen*, 1855-79.

neighbourhood of land. From this I draw the conclusion that the sea scarcely anywhere permanently[1] freezes over where it is of any considerable depth, and far from land. If this be the case, there is nothing unreasonable in the old accounts, and what has happened once we may expect to happen another time.

However this may be, it is certain that the ignominious result of Wood's voyage exerted so great a deterring influence from all new undertakings in the same direction, that nearly two hundred years elapsed before an expedition was again sent out with the distinctly declared intention, which was afterwards disavowed, of achieving a north-east passage. This was the famous Austrian expedition of PAYER and WEYPRECHT in 1872–74, which failed indeed in penetrating far to the eastward, but which in any case formed an epoch in the history of Arctic exploration by the discovery of Franz-Josef's Land and by many valuable researches on the natural conditions of the Polar lands. Considered as a North-east voyage, this expedition was the immediate predecessor of that of the *Vega*.

[1] That thin sheets of ice are formed in clear and calm weather, even in the open sea and over great depths, was observed several times during the expedition of 1868. But when we consider that salt water has no maximum of density situated above the freezing-point, that ice is a bad conductor of heat, and that the clear, newly-formed ice is soon covered by a layer of snow which hinders radiation, it appears to me to be improbable that the ice-covering at deep, open places can become so thick that it is not broken up even by a moderate storm. Even the shallow harbour at Mussel Bay first froze permanently in the beginning of February, and in the end of January the swell in the harbour was so heavy, that all the three vessels of the Swedish Expedition were in danger of being wrecked —*in consequence of the tremendous sea in 80° N.L. in the end of January!* The sea must then have been open very far to the north-west. On the west coast of Spitzbergen the sea in winter is seldom completely frozen within sight of land. Even at Barents' winter haven on the north-east coast of Novaya Zemlya, the sea during the coldest season of the year was often free of ice, and Hudson's statement, "that it is not surprising that the navigator falls in with so much ice in the North Atlantic, when there are so many sounds and bays on Spitzbergen," shows that even he did not believe in any ice being formed in the open sea.

It is so well known through numerous works recently published, and above all by Payer's spirited narrative, that I need not go into further detail regarding it.

But if the North-east voyages proper thus almost entirely ceased during the long interval between Wood's and Payer's voyages, a large number of other journeys for the purpose of research and hunting were instead carried out during this period, through which we obtained the first knowledge founded on actual observations of the natural conditions of Novaya Zemlya and the Kara Sea. Of these voyages, mainly made by Russians and Scandinavians, I shall give an account in the next chapter. It was these that prepared the way for the success which we at last achieved.

CHAPTER VI.

The North-east Voyages of the Russians and Norwegians—Rodivan Ivanov, 1690—The great Northern Expedition, 1734-37—The supposed richness in metals of Novaya Zemlya—Juschkov, 1757—Savva Loschkin, 1760—Rossmuislov, 1768—Lasarev, 1819—Lütke, 1821-24—Ivanov, 1822-28—Pachtussov, 1832-35—Von Baer, 1837—Zivolka and Moissejev, 1838-39—Von Krusenstern, 1860-62—The Origin and History of the Polar Sea Hunting—Carlsen, 1868—Ed. Johannesen, 1869-70—Ulve, Mack, and Quale, 1870—Mack, 1871—Discovery of the Relics of Barents' wintering—Tobiesen's wintering, 1872-73—The Swedish Expeditions, 1875 and 1876—Wiggins, 1876—Later Voyages to and from the Yenisej.

FROM what I have stated above it follows that the coast population of North Russia carried on an active navigation on the Polar Sea long before the English and the Dutch, and that commercial expeditions were often undertaken from the White Sea and the Petchora to the Ob and the Yenisej, sometimes wholly by sea round Yalmal, but most frequently partly by sea and partly by land transport over that peninsula. In the latter case the Russians went to work in the following way; they first sailed through Yugor Straits, and over the southern part of the Kara Sea to the mouth of the Mutnaja, a river debouching on Yalmal; they then rowed or towed the boats up the river and over two lakes to a ridge about 350 metres broad, which forms the watershed on Yalmal between the rivers running west and those running east; over this ridge the boats and the goods were

dragged to another lake, Selennoe, from which they were finally carried down the River Selennaja to the Gulf of Obi.[1]

These and similar accounts were collected with great difficulty, and not without danger, by the Muscovy Company's envoys; but among the accounts that have been thus preserved we do not find a single sketch of any special voyage, on the ground of which we could place a Russian name beside that of Willoughby, Burrough, Pet and Barents in the older history of the North-East Passage. The historical sources of Russia too must be similarly incomplete in this respect, to judge from the otherwise instructive historical introduction to Lütke's voyage. Gallant seamen, but no Hakluyt, were born during the sixteenth and seventeenth century on the shores of the White Sea, and therefore the names of these seamen and the story of their voyages have long since fallen into complete obscurity, excepting some in comparatively recent times.

In the second edition of Witsen's great work we find, at page 913, an account of an unsuccessful hunting voyage to the Kara Sea, undertaken in 1690, that is to say, at a time when voyages between the White Sea and the Obi and Yenisej were on the point of ceasing completely. The account was drawn up by Witsen from an oral communication by one of the shipwrecked men, Rodivan Ivanov, who was for several years mate on a Russian vessel, employed in seal-fishing on the coast of Novaya Zemlya and Vaygats Island.

On the $\frac{11\text{th}}{1\text{st}}$ September this Rodivan Ivanov suffered ship-

[1] Compare: "The names of the places that the Russes sayle by, from Pechorskoie Zauorot to Mongozey" (*Purchas*, iii. p. 539): "The voyage of Master Josias Logan to Pechora, and his wintering there with Master William Pursglove and Marmaduke Wilson, Anno 1611" (*loc. cit.* p. 541): "Extracts taken out of two letters of Josias Logan from Pechora, to Master Hakluyt, Prebend of Westminster" (*loc. cit.* p. 546): "Other obseruations of the sayd William Pursglove" (*loc. cit.* p. 550). The last paper contains good information regarding the Obi, Tas, Yenisej, Pjäsina, Chatanga, and Lena.

wreck with two vessels on Serapoa Koska (Serapov's Bank), probably situated in the Southern part of the Kara Sea. The ice was thrown up here in winter into lofty ice-casts with such a crashing noise that "the world was believed to be coming to an end," and at high water with a strong breeze the whole island was submerged with the exception of some knolls. On one of these the winter house was erected. It was built of clay, which was kneaded with the blood and hair of the seal and walrus. This mixture hardened to a solid mass, of which the walls were built with the help of boards from the vessel. The house thus afforded good protection not only from cold and bad weather, but also from bears. A furnace was also built inside the house and fired with driftwood collected on the beach. Train oil from the captured animals was used for lighting. There wintered here fifteen men in all, of whom eleven died of scurvy. Want of exercise perhaps mainly conduced to bring on this disease. For most of them did not leave the house during the winter night, five weeks long. Those were most healthy who had most exercise, as, for instance, the mate, who was the youngest among the crew, and therefore had to go round the island to collect wood. Another cause of the great mortality was the total want of provisions brought from home. For the first eight days their food consisted of seaweed dredged up from the bottom of the sea, with which some meal was mixed. Afterwards they ate the flesh of the seal and walrus, and of the Polar bear and the fox. The flesh of the bear and the walrus, however, was considered *unclean*,[1] on which account it was eaten

[1] The stringent regulations regarding fasting of the Russians, especially the Old Believers, if they be literally observed, form an insuperable obstacle to the colonisation of high-northern regions, in which, to avoid scurvy, man requires an abundant supply of fresh flesh. Thus, undoubtedly, religious prejudices against certain kinds of food caused the failure of the colony of Old Believers which was founded in 1767 on Kolgujev Island, in order that its members might undisturbed use their old church books and cross themselves in the way they considered most proper. The

only in case of necessity, and the flesh of the fox had an unpleasant flavour. Sometimes the want of food was so great that they were compelled to eat the leather of their boots and furs. The number of the seals and walruses which they caught was so great, "that the killed animals, laid together, would have formed a heap ninety fathoms in length, of the same breadth, and six feet high."[1] They found, besides, on the island a stranded whale.

In spring Samoyeds came from the mainland, and plundered the Russians of part of their catch. Probably for fear of the Samoyeds, the surviving hunters did not go over the ice to the mainland, but remained on the desert island until by a fortunate accident they were rescued by some of their countrymen engaged in a hunting expedition. In connection with the account of this voyage Witsen states that the previous year a Russian hunting vessel stranded *east of the Ob.*

It is probable that towards the close of the sixteenth century the Russian hunting voyages to Novaya Zemlya had already fallen off considerably. The commercial voyages perhaps had long before altogether ceased. It appears as if after the complete conquest of Siberia the land route over the Ural mountains,

same cause also perhaps conduced to the failure of the attempts which are said to have been made after the destruction of Novgorod by Ivan the Terrible in 1570 by fugitives from that town to found a colony on Novaya Zemyla (*Historische Nachrichten von den Samojeden und den Lappländern*, Riga und Mietau, 1769, p. 28). This book was first printed in French at Königsberg in 1762. The author was Klingstedt, a Swede in the Russian service, who long lived at Archangel.

[1] The statement is incredible, and probably originated in some mistake. To form such a heap of walruses at least 50,000 animals would have been required, and it is certain that fifteen men could not have killed so many. If we assume that in the statement of the length and breadth, feet ought to stand in place of fathoms, we get the still excessive number of 1,500 to 3,000 killed animals. Probably instead of 90 we should have 9, in which case the heap would correspond to about 500 walruses and seals killed. The walrus tusks collected weighed 40 pood, which again indicates the capture of 150 to 200 animals.

formerly regarded with such superstitious feelings, was preferred to the unsafe sea route across the Kara Sea, and as if the Government even put obstacles in the way of the latter by setting watches at Matvejev Island and at Yugor Straits.[1] These were to receive payments from the hunters and merchants, and the regulations and exactions connected with this arrangement deprived the Polar Sea voyages of just that charm which had hitherto induced the bravest and hardiest of the population to devote themselves to the dangerous traffic to the Ob, and to the employment of hunting, in which they were exposed to so many dangers, and subject to so great privations.

The circumstance to which we have referred may also be the reason why we do not know of a single voyage in this part of the Polar Sea during the period which elapsed from the voyage of Rodivan Ivanov to "the great Northern Expedition." It examined, among other parts of the widely extended north coast of the Russian empire, the southern portion also of the navigable waters here in question, in the years 1734, 35, under Muravjev and Paulov, and in 1736, 37 under Malygin, Skuratov, and Suchotin. Their main working field however did not lie here, but in Siberia itself; and I shall give an account of their voyages in the Kara Sea further on, when I come to treat of the development of our knowledge of the north coast of Asia. Here I will only state that they actually succeeded, after untold exertions, in penetrating from the White Sea to the Ob, and that the maps of the land between that river and the Petchora, which are still in use, are mainly grounded on the work of the great northern expedition, but that the bad repute of the Kara Sea also arose from the difficulties to which these

[1] *Witsen*, p. 915. Klingstedt states that fifty soldiers with their wives and children were removed in 1648 to Pustosersk, and that the vojvode there had so large an income that in three or four years he could accumulate 12,000 to 15,000 roubles (*Historische Nachrichten von den Samojeden*, &c., p. 53).

explorers were exposed, difficulties owing in no small degree to the defective nature of the vessels, and a number of mistakes which were made in connection with their equipment, the choice of the time of sailing, &c.

Like all distant unknown regions, Novaya Zemlya was of old renowned for its richness in the noble metals. The report indeed has never been confirmed, and probably was occasioned only by the occurrence of traces of ore, and the beautiful gold-glancing film of pyrites with which a number of the fossils found here are covered; but it has, notwithstanding, given occasion to a number of voyages to Novaya Zemlya, of which the first known is that of the mate JUSCHKOV, in 1757. As the mate of a hunting-vessel he had observed the stones glittering with gold and silver, and he succeeded in convincing an Archangel tallow-merchant that they indicated great riches in the interior of the earth. In order to get possession of these treasures the tallow-merchant fitted out a vessel, promising Juschkov at the same time a reward of 250 roubles for the discovery. The whole undertaking, however, led to no result, because the discoverer of these treasures died during the passage to Novaya Zemlya (Lütke, p. 70).

AMMONITE WITH GOLD LUSTRE.
From Novaya Zemlya.
Ammonites alternans.
v. BUCH.

Three years after, in 1760,[1] a hunting mate, SAVVA LOSCHKIN, a native of Olonets, hit on the idea, which was certainly a correct one, that the east coast of Novaya Zemlya, which was never visited by hunters, ought to be richer in game than other parts of the island. Induced by this idea, and probably also by the wish to do something extraordinary, he undertook a hunting expedition thither. Of this expedition we know only that he actually succeeded in travelling round the whole island, thanks

[1] According to Lütke, p. 70. Hamel, *Tradescant d. ältere*, gives the date 1742-44.

to the resolution which led him to spend on this self-imposed task two winters and three summers. It was proved by this journey that Novaya Zemlya is actually an island, a fact which in the middle of last century was still doubted by many geographers.[1]

Even after the failure of Juschkov's expedition the report of the richness of Novaya Zemlya in metals still maintained itself, and accordingly Lieutenant[2] ROSSMUISLOV was sent out with second mate GUBIN, the Polar Sea pilot TSCHIRAKIN, and eleven men, to search for the supposed treasures, and at the same time to survey the unknown portions of the island. The vessel that was used in this Polar Sea voyage must have been a very remarkable one. For shortly before the start, leaks, which had to be stopped, were discovered at many different places in it, and of its power of sailing Rossmuislov himself says: "So long as the wind came from the stern the large sail helped us exceedingly well, but, as soon as it turned and became a head wind, we were compelled to hoist another smaller sail, in consequence of which we were driven back to the point from which we came." Rossmuislov appears to have been a very skilful man in his profession. Without meeting with any obstacle from ice, but at all events with difficulty enough in consequence of the unsuitableness of the vessel, he arrived at Matotschkin Sound, which he carefully surveyed and took soundings in. From a high mountain at its eastern mouth he saw on the $\frac{10\text{th Sept.}}{30\text{th Aug.}}$ the Kara Sea completely free of ice—and the way to the Yenisej thus open; but his vessel was useless for further sailing. He therefore determined to winter at a bay named Tjulanaja Guba, near the eastern entrance to Matotschkin Sound. To this place

[1] Thus on the first map in an atlas published in 1737 by the St. Petersburg Academy, Novaya Zemlya is delineated as a peninsula projecting from Taimur Land north of the Pjäsina.

[2] Properly "Mate, with the rank of Lieutenant," from which we may conclude that Rossmuislov wanted the usual education of an officer.

he removed a house which some hunters had built on the sound farther to the west, and erected another house, the materials of which he had brought from home, on a headland jutting out into the sound a little more to the east. The latter I visited in 1876. The walls were then still standing, but the flat roof, loaded with earth and stones, had fallen in, as is often the case with deserted wooden houses in the Polar regions. The house

VIEW FROM MATOTSCHKIN SCHAR.
(After a drawing by Hj. Théel. 1875.)

was small, and had consisted of a lobby and a room with an immense fireplace, and sleeping places fixed to the walls.

On the $\frac{\text{1st Oct.}}{\text{20th Sept.}}$, Matotschkin Sound was frozen over, and some days after the Kara Sea was covered with ice as far as the eye could reach. Storms from the north-east, west, and north-west, with drifting snow of such violence prevailed during the course of the winter that one could scarcely go ten fathoms from the

house. In its neighbourhood a man was overtaken by such a storm of drifting snow while hunting a reindeer. When he did not return after two days' absence it was determined to note him in the journal as having "perished without burial."

On the $\frac{22}{17}$th April, 1769, there was a storm from the south-west, with mist, rain, and hail as large as half a bullet. On the $\frac{2\text{nd June}}{2\text{nd May}}$ a dreadful wind raged from the north-west, bringing from the high mountains a "sharp smoke-like air,"—it was certainly a *föhn* wind. The painful, depressing effect of this wind is generally known from Switzerland and from north-western Greenland. At the latter place it rushes right down with excessive violence from the ice-desert of the interior. But far from on that account bringing cold with it, the temperature suddenly rises above the freezing-point, the snow disappears as if by magic through melting and evaporation, and men and animals feel themselves suffering from the sudden change in the weather. Such winds besides occur everywhere in the Polar regions in the neighbourhood of high mountains, and it is probably on their account that a stay in the hill-enclosed kettle-valleys is in Greenland considered to be very unhealthy and to lead to attacks of scurvy among the inhabitants.

The crew remained during the winter whole days, indeed whole weeks in succession, in their confined dwellings, carefully made tight, without taking any regular exercise in the open air. We can easily understand from this that they could not escape scurvy, by which most of them appear to have been attacked, and of which seven died, among them Tschirakin. It is surprising that any one of them could survive with such a mode of life during the dark Polar night. The brewing of *quass*, the daily baking of bread, and perhaps even the vapour-baths, mainly contributed to this.

On the $\frac{29}{18}$th July the ice on Matotschkin Schar broke up, and on the $\frac{18\text{th}}{2\text{nd}}$ August the sound was completely free of ice. An attempt was now made to continue the voyage across the Kara

Sea, and an endeavour was made for this purpose to put the vessel, defective from the first, and now still further damaged by ice, in repair, by stopping the leaks, as far as possible, with a mixture of clay and decayed seaweed. "Floating coffins" have often been used in Arctic voyages, and many times with greater success than the stateliest man-of-war. This time, however, Rossmuislov, after having sailed some few miles eastward from Matotschkin Sound, in order to avoid certain loss, had to return to his winter quarters, where he fortunately fell in with a Russian hunter, with whom he commenced his return to Archangel. No precious metals were found, nor "any pearl-mussels," but Tschirakin confided to Rossmuislov the secret that at a certain place on the south coast he had found a block of stone of such extraordinary beauty that in the light of day it shone with the most splendid fire. After Tschirakin's death Rossmuislov sought for the stone, but without success, and he therefore broke out in violent reproaches of his deceased comrade. I can, however, free him from the blame of deception; for, during my voyage in 1875, I found in several of the blocks of schist in the region small veins of quartz, crossing the mass of stone. The walls of these veins were covered with hundreds of sharply-developed rock crystals with mirror-bright faces. Tschirakin's precious stone was doubtless nothing else than a druse of this shining but valueless mineral.

Once more, nearly fifty years after Rossmuislov's voyage, in the year 1807, a miner, LUDLOW, was sent out to investigate more thoroughly the supposed richness of the island in metals. He returned without having found any ore, but with the first accounts of the geological formation of the country; and we have his companion POSPJELOV to thank for some careful surveys on the west coast of Novaya Zemlya.

The next expedition to the island was equipped and sent out from the naval dockyard at Archangel in 1819 under Lieutenant LASAREV, and had, in comparison with its predecessors, very

abundant resources. But Lasarev was clearly unfit for the task he had undertaken, of commanding an Arctic exploratory expedition. In the middle of summer many of his crew were attacked by scurvy. Some few weeks after his departure from Archangel, at a time when pools of excellent drinking-water are

FRIEDRICH BENJAMIN VON LÜTKE.
Born in 1797 in St. Petersburg.

to be found on nearly every large piece of drift-ice, and rapid torrents of melted snow empty themselves everywhere along the coast into the sea, he complains of the difficulty of procuring fresh water, &c. The expedition accordingly was altogether fruitless.

Of much greater importance were Captain-lieutenant (afterwards Admiral Count) LÜTKE'S voyages to Novaya Zemlya in the summers of 1821, 1822, 1823, and 1824, voyages conducted with special skill and scientific insight. The narrative of them form one of the richest sources of our knowledge of this part of the Polar Sea. But as he did not penetrate in any direction farther than his predecessors, an account of these voyages does not enter into the plan of the historical part of this work.

Among Russian journeys the following may be noticed :—

Those of the mate IVANOV in 1822-28, during which he surveyed the coast between the Kara river and the Petchora by overland travelling in Samoyed sleighs.

PACHTUSSOV'S voyages in 1832-35.[1] W. BRANDT, merchant, and KLOKOV, chief of the civil service, at Archangel, sent out in 1832 an expedition with very comprehensive aims from that town, for the purpose of re-establishing the sea-route to the Yenisej, of surveying the east coast of Novaya Zemlya, and of walrus-hunting there. Three vessels were employed, viz., a "carbasse" manned by ten men, including the Commander-lieutenant in the corps of mates Pachtussov, who in previous voyages with Ivanov had become well acquainted with land and people along the coasts of the Polar Sea;[2] the schooner *Yenisej* under Lieutenat KROTOV with ten men; and a hunting *lodja* commanded by the hunting mate GWOSDAREV. Pachtussov was to undertake the east coast of Novaya Zemlya, Krotov to sail through Matotschkin Sound and across the Kara Sea to the

[1] These remarkable voyages were described for the first time, after the accounts of Zivolka, by the academician K.E. v. Baer in *Bulletin scientifique publ. par l'Acad. Imp. des Sciences de St. Petersburg*, t. ii. No. 9, 10, 11 (1837). Before this there does not appear to have been in St. Petersburg any knowledge of Pachtussov's voyages, the most remarkable which the history of Russian Polar Sea exploration has to show.

[2] The carbasse was named, like the vessels of Lasarev and Lütke, the *Novaya Zemlya*. It was forty-two feet long, fourteen feet beam, and six feet deep, decked fore and aft, and with the open space between protected by canvas from breakers.

Yenisej, and Gwosdarev to carry on hunting in order to cover part of the costs of the expedition.

Pachtussov could not penetrate into the Kara Sea, but wintered the first time on South Novaya Zemlya in 70° 36′ N.L. and 59° 32′ E.L. (Greenwich), in an old house which he found there, and which according to an inscription on a cross in its neighbourhood had been built in 1759. This ruinous house was repaired with driftwood, which was found in great abundance in that region. A separate bath-house was built, and was connected with the dwelling-house by a passage formed of empty barrels and covered with canvas. Eleven days were spent in putting the old house into such repair that it could be occupied. It was afterwards kept so warm that the inmates could stay there in their shirt-sleeves without freezing. The Commander, clear-headed and specially fit for his post as he was, did not permit his crew to fall into habits of idleness, dirt, and laziness, but kept them to regular work, bathing and change of linen twice a week. Every second hour meteorological observations were taken. During the whole winter the crew remained in good health, but in spring (March) scurvy broke out, notwithstanding the precautions that were taken, and two men died of it in May. Many times during winter the ice broke up, and at a short distance from the land the Kara Sea was open as far as the eye could reach. A herd of reindeer numbering about 500 head were seen in the end of September; a number of foxes were taken in traps, and two Polar bears were killed. Geese were seen for the first time in spring on the $\frac{27\text{th}}{15\text{th}}$ of May.

Next summer Pachtussov rowed up along the east coast to 71° 38′ N.L. On the west bank of a river, called Savina, he found a very good harbour. He found there the remains of a hut, with a cross erected beside it, on which was the inscription "Savva Th——anov 9th June 1742," which he considered to belong to the time of Savva Loschkin's voyage. After his return from this boat journey Pachtussov went on board his

vessel and sailed along the east coast north of Matotschkin Sound from the $\frac{23rd}{11th}$ July to the $\frac{25th}{13th}$ August without meeting with any obstacle from ice. During this voyage he passed a very good harbour in 72° 26′ N.L., in a bay, called Lütke's Bay. Pachtussov then returned through Matotschkin Sound to the Petchora. Even along the east coast of North Novaya Zemlya the sea was open, but the stock of provisions, intended at their departure from Archangel for fourteen months, was now so low, that the gallant Polar explorer could not avail himself of this opportunity of perhaps circumnavigating the whole of Novaya Zemlya.

Of the two other vessels that sailed from Archangel at the same time as Pachtussov's, the *lodja* returned heavily laden with the spoils of the chase, but on the other hand nothing was ever heard of the *Yenisej*. A concern, not without justification, for its fate, and the desire to acquire as good knowledge of the east coast of the North Island as had been obtained of that of the South, gave occasion to Pachtussov's second voyage.

For this the Government fitted out two vessels, a schooner and a "carbasse," which were named after the two officers of the *Yenisej*, Krotov and Kasakov. The command of the former was undertaken by Pachtussov, and of the latter by the mate ZIVOLKA. This time they wintered in 1834-35 on the south side of Matotschkin Sound at the mouth of the river Tschirakina, in a house built for the purpose, for which they used, besides materials brought with them, the remains of three old huts, found in the neighbourhood, and the wreck of Rossmuislov's vessel which still lay on the beach. The house was a palace in comparison with that in which Pachtussov wintered before. It consisted of two rooms, one 21 feet by 16 feet, intended for the crew (fourteen men), the other 12 feet by 10 feet, for the officers and surgeon, with a bath-house in addition. Matotschkin Sound was frozen over for the first time on the $\frac{28}{16}$th November. The thermometer never sank below the freezing-point of mercury, and the cold of winter could be easily borne,

because the crew wore the Samoyed dress. But the snow-storms were so severe, that sometimes it was impossible for eight days at a time to leave the house, which was so snowed up that the opening in the roof for smoke had several times to be used as a door. The house had no true chimney, but was built like a Lapp hut. Eleven of the bears, who came in large numbers to the hut, were killed, one of them on the roof and another in the porch. During winter the crew were kept in constant employment in killing foxes and at other work. Their state of health was also very good for the circumstances of the time. Only two men died. In spring Matotschkin Sound and part of the east coast of the North Island were surveyed by means of sledge journeys, after which an attempt was made during summer to circumnavigate the North Island, but without success. Lightning accompanied by heavy rain was observed on the $\frac{24}{12}$th June. On the $\frac{15\text{th}}{3\text{rd}}$ September they sailed back to Archangel. Unfortunately soon after his arrival there Pachtussov fell ill of nervous fever and died on the $\frac{19}{7}$th November, 1835. It was a great loss, for by his devotion to the task he had undertaken, by judgment, courage, and endurance, he takes one of the foremost places among the Polar explorers of all countries. Besides, few of the older Arctic expeditions have brought home such a series of valuable astronomical determinations of position, geodetical measurements, meteorological and tidal observations, &c., as Pachtussov.[1]

In 1837 the famous naturalist K. E. VON BAER undertook a voyage to Novaya Zemlya, accompanied by Lieutenant ZIVOLKA, LEHMANN the geologist, RÖDER the draughtsman, and PHILIPPOV

[1] The details of Pachtussov's voyages are taken partly from von Baer's work already quoted, partly from Carl Svenske, *Novaya Zemlya*, &c., St. Petersburg, 1866 (in Russian, published at the expense of M. K. Sidoroff), and J. Spörer, *Nowaja Semlä in geographischer, naturhistorischer und volkswirthschaftlicher Beziehung, nach den Quellen bearbeitet.* Ergänz-Heft. No. 21 zu Peterm. *Geogr. Mittheilungen*, Gotha, 1867.

the conservator.[1] They visited Matotschkin Schar, penetrated by boat to its eastern end and found the Kara Sea open, landing afterwards at Besimannaja Bay, Nechvatova, and on an island in Kostin Schar. The expedition thus nowhere penetrated so far as its predecessors, but it is of importance as the first examination of the natural history of the Polar Sea surrounding Novaya Zemlya carried out by actual men of science. With all the respect we must entertain for von Baer's great name as a scientific man, it cannot be denied that, through his papers on the natural history of the island, grounded on a cursory inspection, a number of erroneous ideas regarding the natural conditions of the eastern Polar Sea obtained a footing in scientific literature.

In order to complete the survey of the island the Russian Government sent out in 1838 a new expedition under Lieutenants Zivolka and MOISSEJEV. They wintered in 1838-39 in Melkaja Guba on the west coast of Novaya Zemlya in 73° 57′ N.L.; but on this occasion Pachtussov's judgment and insight were wanting, and the wintering was very unfortunate. Of the twenty-five men belonging to the expedition most were attacked during winter by scurvy; nine died, among them Zivolka himself. During spring, excursions for the purpose of surveying the neighbouring coasts had to be broken off because they had not brought snow-glasses with them—a thing that Pachtussov did not neglect, being accustomed besides to blacken the under eyelid as a protection against the blinding brightness of the snow. By the expedition, however, considerable stretches of the west coast of Novaya Zemlya were surveyed, and valuable contributions to a knowledge of the climatic conditions of this region obtained. These turned out to be less severe than had been expected. During winter the thermometer never sank below — 33°; in July there were only two nights of frost, and on

[1] *Bulletin scientifique publié par l'Académie Imp. de St. Petersburg*, t. ii. (1837), p. 315; iii. (1838), p. 96, and other places.

two occasions + 18° was observed in the shade; in August there were only three hours of frost. All this depends of course on the neighbourhood of warm marine currents and of a sea open all the year round at a short distance from the coast.

With this unfortunate and to all appearance ill-arranged expedition the Russian Novaya Zemlya voyages ceased for a long time. For before the beginning of the Norwegian hunting

AUGUST KARLOVITZ ZIVOLKA.
Born in 1810 at Warsaw; died in 1839 on Novaya Zemlya.
(After a pen-and-ink drawing communicated by Herr Paul Daschkoff.)

we have only two other Russian voyages to notice in our sketch of the history of the North East passage.

The first of these owed its origin to the desire of the captain of a Russian man-of-war, PAUL VON KRUSENSTERN, to undertake a voyage in the Polar Sea in a schooner, the *Yermak*, which belonged to him and which was for the time lying at the Petchora, in order to survey the coasts lying to the eastward. He intended himself to undertake the command, and to take

with him as second in command his son PAUL VON KRUSENSTERN, lieutenant in the Russian marine. The latter was sent before to equip the *Yermak*, which he did with wonderful judgment and skill, in the best way possible, in a region where at that time nearly every requisite for the equipment of a vessel was wanting. The elder Krusenstern was unable to reach the place

PAUL VON KRUSENSTERN, JUNIOR.
Born at Revel in 1834; died at Dorpat in 1871.

of sailing in time, on which account the command was given to the son.

He left the mouth of the Petchora on the $\frac{10\text{th Sept.}}{29\text{th Aug.}}$ 1860. Three days after he reached the Kara port, which was completely free of ice, as was the sea to the eastward. But the late season

of the year, the defective equipment of the *Yermak*, and, it would appear, the wording of the orders he had received, compelled him to turn after he had penetrated some distance into the Kara Sea. On the $\frac{19}{7}$th September accordingly he was again at the Petchora, without having reached his goal. The

MICHAEL KONSTANTINOVITSCH SIDOROFF.
Born in 1823 at Archangel.

attempt to penetrate eastwards from this river was resumed at the instance of MICHAEL SIDOROFF, afterwards so well known as the restless promoter of sea-communication between Siberia and Europe. The *Yermak* was repaired, along with a decked Norwegian pilot-boat, which was named the *Embrio*. The

command was undertaken by P. von Krusenstern, junior. He left the anchorage Kuya on the Petchora on the $\frac{19\text{th}}{1\text{st}}$ August. On the $\frac{26}{14}$th August, the two small vessels sailed into Yugor Schar, after having been long detained during their course by storms and head-winds. Some huts erected by hunters were seen on the right shore of the sound, and on both sides of it Samoyed "chums" (tents of reindeer skin) and reindeer. The inhabitants had climbed up on the roofs and indicated their astonishment by gesticulations. Both vessels anchored in the neighbourhood of Vaygats Island. But a couple of hours afterwards large masses of ice drove with an altered current into the harbour, forced the *Yermak* from its anchor and carried the vessel into the Kara Sea. It was only with great trouble that it was released from the ice and anchored in the eastern mouth of Yugor Schar.

On the $\frac{27}{15}$th von Krusenstern again weighed anchor, either to sail to the eastward or to search for a more secure anchorage than that which he had been compelled for the time to make use of. But the wind was so light that he could not hold a course independent of the currents. It was, therefore, necessary to moor the vessel to a large ice-field, and with this the *Yermak* during the following days drifted farther and farther. Soon the vessel was completely enclosed by the ice, and thus rendered unmanageable. The weather was often fine, the thermometer showed + 4°, a strong aërial reflection elevated images of the pieces of ice at the horizon, and gave them the most wonderful and beautiful forms. Everywhere there were upon the ice fresh-water pools, some of which were of great extent and of no inconsiderable depth. Thus, on the ice-field lying nearest the vessel there were different "lakes," one of which was used for drinking, another for filling the water-casks, a third to supply washing-water to the crew, and a fourth for washing their clothes.

On the $\frac{3\text{rd Sept.}}{22\text{nd Aug.}}$ the ice began to be pressed together by a light

W.S.W. wind. Convinced that the vessel would soon be nipped, the men on board began to save the stock of provisions and the boats, by placing them on the ice, but the pressure soon ceased. There fell a heavy rain, which afterwards, when the wind changed to north-west, passed into snow. On the $\frac{7\text{th Sept.}}{20\text{th Aug.}}$ the coast of Yalmal was sighted. A fathom-thick ice-floe shot under the vessel and caused it to heel over to starboard. The following day there was a storm from the S.S.W. with snow. The ice forcing itself forward shook the vessel several times so violently that the crew rushed up to save the provisions, &c., on the ice. They were now in the neighbourhood of 70° N.L. and 65° E.L. (Greenwich), almost right off the mouth of the Kara river. The crew worked the whole day with axes and iron bars hewing off the sharp projecting corners of the ice-blocks that were pressed against the vessel. On the $\frac{11\text{th Sept.}}{30\text{th Aug.}}$ there was warm weather with rain. The ice was in so violent motion that it was impossible to walk upon it. On the afternoon of the same day the *Yermak* sustained several violent concussions, and the hull was lifted one foot. On the $\frac{13\text{th}}{1\text{st}}$ September, a violent storm broke out, which drove the vessel to the north-east. It was expected every moment that the vessel would be nipped, and a tent was accordingly pitched on the ice, in order that part of the provisions from the hold might be placed in it. Wood even was carried to it. It was Russia's thousand-years' day, and it was celebrated with a festive ball and merry songs, although they every instant expected their vessel to be crushed by the masses of ice that were pressed together by the fearful storm. On the $\frac{14\text{th}}{2\text{nd}}$ September, the stem of the vessel was forced five feet above the water-line, and the whole night a continual cracking of timbers was heard in the hull. The water rose rapidly to a depth of two feet. Every man left the vessel and removed to the ice, but soon after the immense ice-field on which the tent was pitched went in pieces, while the leak in the vessel closed, and the crew in consequence went on board again. On

the $\frac{18th}{3rd}$ September, the vessel was again pressed so, that the deck at times was bent to the form of a vault. On the $\frac{19th}{7th}$ September, von Krusenstern called the crew together that they might choose from their number three persons to advise with the commander on the best means of making their escape, and two days after the vessel was abandoned, after a meal at which the crew were literally offered all the house afforded. They then broke up for a journey to land, which was exceedingly difficult on account of the unevenness of the ice. They were soon obliged to leave the boat, which they had at first endeavoured to drag along with them over the ice, and take the most indispensable of the provisions on their own backs. On leaving the ship a sailor had secretly got possession of so much brandy, that during the first day's march he had the opportunity of drinking himself dead drunk. To carry him along was not possible, to wait was not advisable. He was left therefore to sleep off the drink; and in order that he might do so as soon as possible they took off his clothes and left him lying upon the ice with only his shirt on. Next day, however, he got up with his comrades after following their track in the darkness the whole night. Open places were often met with, which the travellers had to cross on pieces of drift-ice rowed forward by boat-hooks. Once when the shipwrecked men were ferrying themselves over upon a piece of ice which was already fully loaded, six walruses were seen in the neighbourhood. They showed a disposition to accompany the seafarers on the piece of ice, which in that case would certainly have sunk, and it was only after a ball had been sent through the leader's head that the animals gave up their plan for resting, which gave evidence of a gregariousness as great as their want of acquaintance with mankind. After Krusenstern and his companions had for several days in succession drifted backwards and forwards on a piece of ice in the neighbourhood of land, and traversed long stretches by jumping from one piece of ice to another, they at last reached the shore

on the $\frac{28}{16}$th September. In the immediate neighbourhood they found an encampment, whose inhabitants (Samoyeds) gave the shipwrecked men a friendly reception, and entertained them with the luxuries of the reindeer herd—raw and cooked reindeer flesh, reindeer tongues, reindeer marrow—raw fish and goose-fat. After the meal was finished the exhausted wanderers lay down to sleep in the Samoyed tents on the soft reindeer skins; "all sorrows and difficulties were forgotten; we felt a boundless enjoyment, as if we had come to paradise." Thence they travelled in reindeer sledges to Obdorsk, everywhere received in a friendly and hospitable manner by the wild tribes on the way, although the hospitality sometimes became troublesome, as for instance when an Ostyak compelled von Krusenstern to drink tea six times a day, and six cups each time, and offered him as a special luxury an extract of tobacco in brandy.[1]

Krusentern's adventurous journey across the Kara Sea is one of the many proofs that a Polar navigator ought above everything to avoid being beset. The very circumstance that the ice-field, in which he became fixed in the neighbourhood of Yugor Schar, could drift across to the east coast of the Kara Sea, shows that it was for the most part open, and that a steamer or a good sailing-vessel that year, and probably also the preceding, might very readily have reached the mouth of the Ob or the Yenisej. The narrative of von Krusenstern's journey is besides the first complete sketch we have of a passage from west to east over the Kara Sea. Little idea could any one then have that within a single decade a number of vessels should sail free and unhindered along this route.

Soon after the two voyages I have described above, and before they became generally known in the geographical literature of Western Europe, a new era began in the navigation of the Kara Sea, which was brought about by the Norwegian

[1] Paul von Krusenstern, *Skizzen aus sienem Seemannsleben. Seinen Freunden gewidmet.* Hirschberg in Silesia, without date.

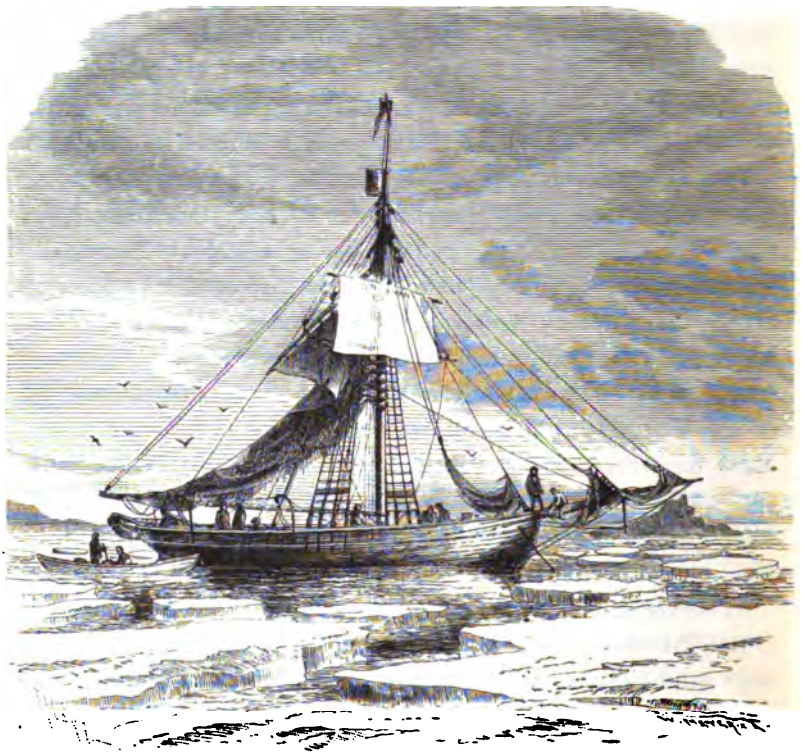
hunters being compelled to seek for new fields of sport on and beyond Novaya Zemlya.

The history of the Spitzbergen hunting has not yet been written in a satisfactory way, and is in many respects very obscure. It is supposed that after the discovery of Spitzbergen in 1596 by Barents, the hunting in the Polar Seas began during BENNET'S first voyage in 1603, and that the whale-fishing was introduced by JONAS POOLE in 1610. But already in the following year Poole, whose vessel was then wrecked on the west coast of Spitzbergen, found in Horn Sound a ship from Hull, to which he gave charge of saving his cargo, and two years after the English were compelled, in order to keep foreigners from the fishing field they wished to monopolise, to send out six men-of-war, which found there eight Spanish, and a number of Dutch and French vessels (*Purchas*, iii. pp. 462, 716, &c.). Even in our days the accounts of new sources of wealth do not spread so speedily as in this case, unless, along with the history of the discovery which was written by Hakluyt, Purchas, De Veer, &c., there had been an unknown history of discovery and the whale-fishing, of which it may still be possible to collect some particulars from the archives of San Sebastian, Dunkirk, Hull, and other ports.

However this may be, it is certain that the English and Dutch North-east voyages gave origin to a whale-fishery in the sea round Spitzbergen, which increased by many millions the national wealth of these rich commercial states. The fishing went on at first immediately along the coasts, from which, however, the whales were soon driven, so that the whale-fishers had to seek new fishing-grounds, first farther out to sea between Spitzbergen and Greenland, then in Davis' Strait, and finally in the South Polar Sea, or in the sea on both sides of Behring's Straits.

Spitzbergen, when the whale-fishing ceased in its neighbourhood, was mostly abandoned, until the Russians began to settle

there, principally for the hunting of the mountain fox and the reindeer. Of their hunting voyages we know very little, but that they had been widely prosecuted is shown by the remains of their dwellings or huts on nearly all the fjords of Spitzbergen.



NORWEGIAN HUNTING SLOOP.

The *Proeven*, employed by the Swedish Expedition to the Yenisej in 1875.

They seem to have often wintered, probably because the defective build of their vessels only permitted them to sail to and from Spitzbergen during the height of summer, and they could not thus take part without wintering in the autumn

hunting, during which the fattest reindeer are got; nor could the thick and valuable fur of the winter-fox be obtained without wintering.[1] But the hunting voyages of the Russians to Spitzbergen have also long ceased. The last voyage thither took place in 1851–52, and had a very unfortunate issue for most of those who took part in it, twelve men dying out of twenty. On the other hand, the Norwegian voyages to Spitzbergen for the seal and walrus-hunting, begun in the end of last century, still go on. Their history, too, is, even here in the North, very incompletely known, at least to 1858, when the Swedish scientific expeditions began regularly to visit those regions, and to include in the narratives of their voyages more or less complete accounts of the Norwegian hunting, an example that has since been followed, though by no means very completely or systematically, by the editors of Norwegian and foreign journals, in the first place by Petermann's *Mittheilungen*.[2]

Between 1860 and 1870 the game (walrus, seal, bear, and reindeer) began to diminish in such a degree that the hunters were compelled to seek for themselves new hunting-grounds. They turned to the north and east, the less accessible parts of Spitzbergen, afterwards still farther eastwards towards Novaya

[1] Information regarding the mode of life of the Russian hunters on the coasts of Spitzbergen is to be found in P. A. le Roy, *Relation des avantures arrivées à quatre matelots Russes, &c.* 1766; Tschitschagov's *Reise nach dem Eismeer*, St. Petersburg, 1793; John Bacstrom, *Account of a voyage to Spitzbergen*, 1780, London, 1808 (as stated; I have not seen this work); B. M. Keilhau, *Reise i Öst og Vest Finmarken, samt til Beeren-Eiland og Spetsbergen i Aarene 1827 og 1828*, Christiania, 1831; A. Erman, *Archiv für wissenschaftliche Kunde von Russland*, Part 13 (1854), p. 260; K. Chydenius, *Svenska expeditionen till Spetsbergen 1861* (p. 435); Dunér and Nordenskiöld, *Svenska Expeditioner till Spetsbergen och Jan Mayen 1863 och 1864* (p. 101).

[2] Before 1858 there is to be found in Petermann's *Mittheilungen* only a single notice of the Norwegian Spitzbergen hunting, the existence of which was at the time probably known to no great number of European geographers.

Zemlya, and beyond this island to the Kara Sea, and they penetrated farther than all their predecessors. In the history of the North-east Passage therefore some pages must always be devoted to the bold voyages to Novaya Zemlya of these small hunting sloops, provisioned only for the summer.

ELLING CARLSEN.
Born at Tromsoe in 1819.

The Norwegian hunter who first visited Novaya Zemlya was ELLING CARLSEN, afterwards known as a member of the Austrian Polar expedition. In 1868 he sailed in a sloop from Hammerfest on a hunting voyage eastward, forced his way into the Kara Sea through the Kara Port, but soon returned through Yugor Schar, and then sailed northwards as far as Cape Nassau. Induced by the abundance of game, he returned next year to the

same regions, and then succeeded in penetrating the Kara Sea as far as the neighbourhood of Beli Ostrov, whence he returned to Norway through Matotschkin Schar. Carlsen's lead was immediately followed by several Norwegian hunters, one of whom, EDWARD JOHANNESEN, made a very remarkable voyage, of which I will here give a brief account.

Johannesen anchored on the 31st May, 1869, at Meschduschar Island, without having seen any drift-ice in the course

EDWARD HOLM JOHANNESEN.
Born in 1844, at Balsfjord Parsonage.

of his voyage. He then sailed up along the west coast of Novaya Zemlya in nearly open water past Matotschkin Sound to Cape Nassau, which was reached on the 19th June. Hence he returned, following the coast toward the south, until, on the 29th June, he sailed through the Kara Port into the Kara Sea. This was passed in very open water, and after coming to its

eastern side he followed the coast of Yalmal towards the north to Beli Ostrov. This island was reached on the 7th August, and from it he steered south along the east coast of Novaya Zemlya to the Kara Port, through which he returned to Norway.[1]

The same year, the English sportsman, Mr. JOHN PALLISER[2] sailed across the Kara Sea, through Matotschkin Schar to Beli Ostrov. He returned through Yugor Schar with abundance of booty[3] from the hunting grounds where formerly the walruses tumbled undisturbed among the drift-ice, and where the white bear has not yet met his superior.[4]

These voyages are amongst the most remarkable that the history of Arctic navigation can show. They at once overturned all the theories which, on the ground of an often superficial study of preceding unsuccessful voyages, had been set up regarding the state of the ice east of Novaya Zemlya, and they thus form the starting-point of a new era in the history of the North-east Passage.

After his return to Norway Johannesen sent to the Academy of Sciences in Stockholm a paper on his voyage in 1869, and on his hydrographical observations in the Kara Sea, for which he received a silver medal. This I was commissioned to send him, and in the correspondence which took place regarding it I on one occasion said in jest that a circumnavigation of Novaya Zemlya would certainly entitle him to a gold medal from the

[1] The first account of this voyage was published in *Öfversigt af Svenska Vetenskaps-akademiens förhandlingar*, 1870, p. 111.

[2] *Athenæum*, 1869, p. 498. Petermann's *Mittheilungen*, 1869, p. 391.

[3] Palliser's game consisted of 49 walruses, 14 Polar bears and 25 seals; that of the working hunters was many times greater. All the vessels which went from Tromsoe that year captured 805 walruses, 2,302 seals, 53 bears, &c.

[4] Sidoroff too started in 1869 on a north-east voyage in a steamer of his own, the *George*. However, he only reached the Petchora, and the statement that went the round of the press, that the *George* actually reached the Ob, is thus one of the many mistakes which so readily find their way into the news of the day.

same famous scientific institution that had given him the silver medal. I myself travelled the following summer, in 1870, to Greenland, and returned thence late in autumn. I then had the pleasure of receiving from Captain Johannesen a new paper, afterwards inserted in the *Öfversigt*, of the transactions of the Royal Academy of Sciences for the year 1871, p. 157, "Hydrografiske Iakttagelser under en Fangsttour 1870 rundt om Novaja Zemlja." Johannesen now as on the first occasion sailed backwards and forwards along the west coast of Novaya Zemlya, then through the Kara Port, which was passed on the 12th July. He then followed the east coast of Vaygats to Mestni Island, where he came in contact with Samoyeds, in connection with which he makes the remark, certainly quite unexpected by philologists, that in the language of the Samoyeds "certain Norwegian words were recognised." Their exterior was not at all attractive. They had flat noses, their eyes were dreadfully oblique, and many had also oblique mouths. The men received the foreigners drawn up in a row, with the women in the second rank. All were very friendly. On the 11th August he was on the coast of Yalmal in 71° 48′ N.L., whence he sailed over to Novaya Zemlya in order to take on board wood and water. He anchored in the neighbourhood of Udde Bay in 73° 48′ N.L., and saw there twenty wild reindeer. Then he sailed again over the Kara Sea to Yalmal.

During these cruisings in the Kara Sea the summer had passed. Johannesen's vessel was now full, but notwithstanding this he determined, at a season of the year when the walrus-hunters commonly return to Norway, to see whether the offered prize could not be won into the bargain. The course was shaped first to the north-east, then westward to the north coast of Novaya Zemlya, which was reached on the 3rd September. The whole sea here was open, which Johannesen, on the ground of finding Norwegian fishing-net floats among the driftwood, attributed to the action of the Gulf Stream. Hence he returned

to Norway, after having completed a voyage which some years before all geographical authorities would have considered an impossibility. I need scarcely mention that the Academy in Stockholm redeemed the promise which one of its members had given without the necessary authority. Johannesen was then twenty-six years old. Son of a skilful hunter, he had from his childhood taken part in Arctic voyages, and thus grown up in the employment to which he had devoted himself.

The same year several other walrus-hunters also made remarkable voyages in the Kara Sea. Captain E. A. ULVE first sailed along the west coast of Novaya Zemlya to 76° 47′ N.L., then back to Matotschkin Schar, through which he passed on the 7th and 8th August into the Kara Sea, which was completely free of ice, with the exception of some few very scattered pieces. After sailing backwards and forwards in different directions in the Kara Sea, he returned through the Kara Port on the 24th August. Captain F. E. MACK made a similar voyage. He sailed from the 28th June to the 8th July northwards along the west coast of Novaya Zemlya, which was free of ice between the Petchora and the Admiralty peninsula, where fast ice was found, and fourteen sailing vessels and two steamers were now assembled. On the 8th and 9th June thunder was heard here. From the Admiralty peninsula Mack sailed again, first to the south, and then, on the 18th July, through Matotschkin Sound into the Kara Sea, which was nearly free of ice. Captain P. QUALE, again, and A. O. NEDREVAAG, sailing master, penetrated through Yugor Sound into the Kara Sea, and sailed there to 75° 22′ N.L., and 74° 35′ E.L. (Greenwich).[1]

[1] Petermann's *Mittheilungen*, 1871, p. 97. Along with Ulve's, Mack's, and Quale's voyages, Petermann refers to a voyage round Novaya Zemlya by T. Torkildsen. In this case, however, Petermann was exposed to a possibly unintended deception. Torkildsen, who visited the Polar Sea for the first time in 1870, indeed made the voyage round Novaya Zemlya, but only as a rescued man on Johannesen's vessel. Torkildsen's own vessel, the *Alfa*, had been wrecked on the 13th July at the bottom of Kara Bay, after

Also in 1871 a number of walrus-hunters made remarkable voyages in the Kara Sea. Of these, however, only one, Mack, in the schooner *Pole Star*, penetrated eastwards farther than all his predecessors. On the 14th June he sailed into the Kara Sea through the Kara Port, but found the sea still covered with continuous fast ice, from 1·8 to 2 metres in thickness. He therefore turned and sailed northwards along the west coast of Novaya Zemlya to the Gulf Stream Islands (76° 10′ N.L.), where he remained till the 3rd of August. The temperature of the air rose here to + 10°·5. The name, which the Norwegian walrus-hunters have given these islands, owes its origin to the large number of objects from southern seas which the Gulf Stream carries with it thither, as floats from the Norwegian fisheries, with their owner's marks frequently recognisable by the walrus-hunters—beans of *Entada gigalobium* from the West Indies, pumice-stone from Iceland, fragments of wrecked vessels, &c. On the 3rd of August Mack passed the northernmost promontory of Novaya Zemlya. Hence he sailed into the Kara Sea, where at first he fell in with ice. Farther on, however, the ice disappeared completely, and Mack on the 12th of September reached 75° 25′ N.L. and 82° 30′ E.L. (Greenwich) according to Petermann, but 81° 11′ Long. according to the *Tromsoe Stiftstidende*. He returned through Yugor Schar, which was passed on the 26th September.[1] The same year E. Johannesen, after long endeavouring without success to make his way into the Kara Sea through the southern strait, sailed northwards along the west coast of Novaya Zemlya, and did not leave Cape Nassau until the 15th October.

which the skipper and six men were saved by Johannesen, yet by no means so that Torkildsen, as is stated by Petermann, had the least command of the vessel that saved him. (Cf. *Tromsoe Stiftstidende*, 1871, No. 23.)

[1] *Tromsoe Stiftstidende*, 1871, No. 83; Petermann's *Mittheilungen*, 1872, p. 384.

From the same year too Petermann also publishes very remarkable journals of the Norwegian walrus-hunting captains, S. TOBIESEN, H. CH. JOHANNESEN, J. N. ISAKSEN, SÖREN JOHANNESEN, DOERMA, SIMONSEN, and E. CARLSEN; but as none of these gallant seamen that year penetrated to the north or east beyond the points which their predecessors had reached, I may be allowed with regard to their voyages to refer to *Mittheilungen* for 1872 (pp. 386—391 and 395), also to the maps which are inserted in the same volume of that journal (pl. 19 and 20), and which are grounded on the working out by Prof. H. MOHN, of Christiania, of his countrymen's observations. With respect to Captain E. Carlsen's voyage, however, it may be stated, that in the course of it a discovery was made, which has been represented as that of an Arctic Pompeii, remarkably well protected against the depredation of the tooth of Time, not indeed by lava and volcanic ashes, but by ice and snow. For when Carlsen on the 9th September landed on the north-east coast of Novaya Zemlya in 76° 7′ N.L., he found there a house, 10 metres long and 6 metres wide, with the roof fallen in, long since abandoned and filled with gravel and ice. From this frozen gravel were dug up a large number of household articles, books, boxes, &c., which showed that they were relics of Barents' winter dwelling, which now, almost three hundred years after the place had been abandoned, came to the light of day, so well preserved that they gave a lively idea of the way in which the European passed his first winter in the true Polar regions. When Carlsen had erected a cairn in which he placed a tin canister containing an account of the discovery, he took on board the most important of the articles which he had found and returned to Norway. There he sold them at first for 10,800 crowns to an Englishman, Mr. Ellis C. Lister Kay, who afterwards made them over for the price he had paid for them to the Dutch Government. They are now to be found arranged at the Marine Department at the Hague in a model room, which is an

exact reproduction of the interior of Barents' house on Novaya Zemlya.[1]

After Carlsen, Barents' winter haven was visited in the year 1875 by the Norwegian walrus-hunter, M. GUNDERSEN, who among other things found there a broken chest containing two maps and a Dutch translation of the narrative of Pet's and Jackman's voyages, and in the year 1876 by Mr. CHARLES GARDINER, who through more systematic excavations succeeded in collecting a considerable additional number of remarkable things, among which were the ink-horn and the pens which the Polar travellers had used nearly three centuries ago, and a powder-horn, containing a short account, signed by Heemskerk and Barents, of the most important incidents of the expedition. Gundersen's *find* is still, as far as I know, at Hammerfest; Gardiner's has been handed over to the Dutch Government to be preserved along with the other Barents relics at the Hague.

In 1872 the state of the ice both north of Spitzbergen and round Novaya Zemlya was exceedingly unfavourable,[2] and several of the scientific expeditions and hunting vessels, which that year visited the Arctic Ocean, there underwent severe calamities and misfortunes. Five of the best hunting vessels from Tromsoe were lost in the ice; the Swedish expedition, which that year started for the north, could not, as was intended, erect its winter dwelling on the Seven Islands, but was compelled to winter at the more southerly Mussel Bay; and the Austrian expedition under the leadership of Payer and Weyprecht was beset by ice a few hours after its campaign had commenced in

[1] Cf. *The Three Voyages of William Barents*, by Gerrit de Veer, 2nd Edition, with an Introduction by Lieutenant Koolemans Beynen. London, 1876 (Works issued by the Hakluyt Society, No. 54).

[2] The sea in the neighbourhood of Spitzbergen on the east was on the other hand very open that year, so that it was possible for the same time to reach and circumnavigate the large island situated to the east of Spitzbergen, which had been seen in 1864 by Dunér and me from the top of White Mount in the interior of Stor Fjord.

earnest. It is well known how this carefully equipped expedition afterwards for two winters in succession drifted about in the Polar Sea, until it finally came to a standstill at a previously unknown land lying north of Novaya Zemlya, which was named after the Austrian Emperor, Franz Josef. These two expeditions, however, did not touch the territory of the *Vega's* voyage, on which account I cannot here take any further notice of them.[1] But the same year a wintering took place on the west coast of Novaya Zemlya, of which I consider that I ought to give a somewhat more detailed account, both because in the course of it one of the most gallant Polar voyagers of Norway met his fate, and because it shows us various new, hitherto untouched sides of winter life in the High North.

SIVERT TOBIESEN was one of the oldest and boldest of the Norwegian walrus-hunting skippers; he had with life and soul devoted himself to his calling, and in it was exposed to many dangers and difficulties, which he knew how to escape through courage and skill. In 1864 he had sailed round the north-eastern part of North-east Land, and had been very successful in hunting; but as he was about to return home, his vessel was beset by ice near the southern entrance to Hinloopen Strait, where the same fate also overtook two other hunting sloops, one of them commanded by the old hunting skipper MATTILAS, who in the winter of 1872–73 died in a tent at Grey Hook, the other by the skipper J. ÅSTRÖM. They were compelled to save themselves in boats, in which they rowed through Hinloopen Strait to the mouth of Ice Fjord, where the shipwrecked crews were met and saved by the Swedish expedition of 1864. He

[1] Nor does space permit me to give an account of various expeditions, which indeed concerned Novaya Zemlya, but did not penetrate farther eastward than their predecessors; for instance, the Rosenthal expedition of 1871, in which the well-known African traveller and Spitzbergen voyager Baron von Heuglin, and the Norwegian botanist Aage Aagaard, took part as naturalists; Payer and Weyprecht's voyage of reconnaissance in the sea between Spitzbergen and Novaya Zemlya in 1871, &c.

passed the winter of 1865–66 happily, in a house built for the purpose on Bear Island, and communicated to the Swedish Academy of Sciences a series of valuable meteorological observations, made during the wintering.[1] After 1868 he had made several successful voyages to Novaya Zemlya, some of which were also remarkable from a geographical point of view, and in 1872 he was also on a hunting expedition to the same regions.

SIVERT KRISTIAN TOBIESEN.
Born at Tromsoe in 1821, died on Novaya Zemlya in 1873.

As he could not enter the Kara Sea, he sailed up along the west coast, where in the middle of September he was beset in the neighbourhood of the Cross Islands. Hence seven of the crew travelled south in a boat to seek for a vessel, but Tobiesen himself, his son and two men, remained on board. Their stock of provisions consisted of only a small barrel of bread, a sack of

[1] Kongl. *Svenska Vetenskaps-akademiens handlingar*, 1869.

corners and fragments of ship biscuit, a small quantity of coffee, tea, sugar, syrup, groats, salt meat, salt fish, a few pounds of pork, a couple of tin canisters of preserved vegetables, a little bad butter, &c. There was abundance of wood on board and on the land. Notwithstanding the defective equipment they went on bravely and hopefully with the preparations for wintering, gathered drift-wood in heaps on the beach, threw a tent of

TOBIESEN'S WINTER HOUSE ON BEAR ISLAND.
(After a sketch by the Author.)

sails over the vessel, threw up snow about its sides, covered the deck with the hides of the seals and walruses that had been captured during summer, did what could be done to bring about good ventilation on board, &c. A large number of bears came to the winter station at the commencement of the wintering, affording an abundant supply of fresh bears' flesh. So long as this lasted, the health of the party was

good, but when it came to an end at the new year, their food for three weeks consisted mainly of ill-smelling salt bears' flesh. Tobiesen and one of the men were now taken ill. The cold sank to − 39½° C.[1] On the 29th April, 1873, Tobiesen died of scurvy. In the month of May his son was also attacked, and died on the 5th July. The two men also suffered from scurvy, but recovered. They rowed south in the month of August, and were rescued by a Russian hunting-vessel.

The seven men, the harpooner Henrik Nilsen, Ole Andreas Olsen, Axel Henriksen, Amandus Hansen, Nils Andreas Foxen, Johan Andersson and Lars Larsen, who rowed away in autumn, had an exceedingly remarkable fate. When they left the vessel they could only take with them fourteen ship biscuits, six boxes of lucifers, two guns, with ammunition, a spy-glass, a coffee-pot and an iron pot, but no winter clothes to protect them from the cold. At first, in order to get to open water, they had to drag the boat about seven kilometres over the ice. They then steered southwards along the land. The journey was made under circumstances of great difficulty and privation. The darkness and cold increased, as did the storm, and what was worst of all their stock of provisions was very soon consumed. On the second day, however, they were fortunate enough to shoot a bear; afterwards they also succeeded in killing a pair of seals. Finally, after having partly rowed and partly sailed about three weeks (they had no almanac with them), and travelled nearly 400 kilometres, they came to two small hunting or store houses, which the Russians had built on the north side of Gooseland. In order to have at least a roof over their heads the exhausted men settled there, though in the house they

[1] At Mussel Bay, too, during the winter of 1872-73, the greatest degree of cold was the same; that is to say, at neither place did it reach the freezing-point of mercury. At the *Vega*'s winter station, on the contrary, it was considerably greater.

found neither food, clothes, nor hunting implements. They were all much enfeebled by hunger, thirst, cold, and the long boat journey; their feet were swollen and partly frost-bitten.

They remained in the house three weeks, and during that time shot a seal, two white foxes, and four reindeer, with which they kept in their lives; but as it appeared that there were no more reindeer to be had, and there were no more opportunities of shooting seals or reindeer, they determined to leave the house and endeavour to get to Vaygats Island. When they broke up, Ole Andreas Olsen and Henrik Nilsen took the guns and ammunition, while the other five commenced the journey with some small sledges they had found at the house, on which they loaded what they had of clothes and other articles. The boat was left behind. Soon after they left the house Ole Andreas Olsen and Henrik Nilsen were separated in a snow-storm from the others who drew the sledges. The latter now agreed to determine by lot whether they should return to the house or continue their journey, and when the lot fell for the latter they allowed it to settle the matter, and so went south.[1]

Their position was now desperate in the extreme. When they left the house they had about half a pound of reindeer flesh and a little blubber remaining. The weather was dreadful; they were badly clothed, and they wanted water. In consequence they could make only very short days' marches. At night they buried themselves in the snow, and while the rest slept, one man kept constant watch, to prevent the others from being snowed up and to keep the bears at a distance. They all held out till the sixth night. Then Amandus Hansen died. The rest were compelled to leave him in the snow and continue their journey as well as they could, but they had by degrees become so weak and exhausted that, after having traversed

[1] It is very common that the hunters in cases of importance and danger when it is difficult to settle what course ought to be taken, permit the drawing of lots to determine the choice.

probably about 100 kilometres, for the most part along the coast, they had to leave even the sledges and the most of what they had with them. The seventh or eighth day they caught sight of a little pile of fuel, and the track of a sledge in the snow. By following this track for about ten kilometres they found a small house, inhabited by Samoyeds, who immediately gave them a friendly reception, and entertained them in the most hospitable way. In particular they showed much kindness to Nils Andreas Foxen, whose toes were frost-bitten, and who was in other respects much enfeebled.

These Samoyeds, three men, three women, and a boy, spoke Russian. They had settled for the winter on the south part of Gooseland to shoot the seal and the walrus. They had with them a large barge, besides some small Samoyed boats, and were comparatively well provided with reindeer flesh, meal, tea, sugar, &c. Their guns were old flint-lock fowling-pieces, but they were good shots. With these Samoyeds the four ship-wrecked men remained the whole winter, and were tolerably well off. When the weather permitted they assisted the Samoyeds in capturing seals, and when the weather was bad they passed the time as well as they could, the Samoyeds generally employing themselves in playing cards or draughts. In order to avoid scurvy the Samoyeds often took exercise in the open air, and ate reindeer flesh, partly cooked and partly raw, and drank the blood. They lived in the house until March was well advanced, when, for want of fuel, they were obliged to hew it down. Instead they removed into a tent of reindeer skin. These Samoyeds appear to have been Christians in name, though they must have had strange ideas of their new God. When, for instance, they saw a seal and missed shooting it, they shot at the sun, because they believed that God was angry with them. They lived in a sort of marriage, but if the man became unfriendly to the woman, or tired of her, he could take another; they had no clocks, but, notwithstanding, had a

tolerably good idea of time by the help of the stars and the sun; instead of an almanac they used a piece of wood, in which for every day they cut a notch. Although they sometimes quarrelled with and threatened one another, they were, however, on the whole friendly, and reasonable, and showed much kindness to the four shipwrecked men, whom they provided with warm skin clothes, and during the whole time with food in abundance, according to their circumstances, so that they did not suffer any want.

Ole Andreas Olsen and Henrik Nilsen had, when they were separated in the snowstorm from the sledge party, half a pound of flesh and their guns, and nothing more. They did not succeed in finding any game, and though they were not very far from the house, they required three days and a half to get back to it. In the meantime, also, these two comrades in misfortune had been separated. Henrik Nilsen found the house first, lighted a fire, roasted and ate some pieces of fox flesh that he found remaining. Ole Andreas Olsen, who in desperation had endeavoured to quench his thirst with sea-water, was so weak that, when late at night he came to the boat, he could not crawl up to the house. He had kept himself in life by eating snow and devouring large pieces of his "pesk," which was made of the raw hides of reindeer he had previously shot. After having lain a while in the boat he crept up to the house, where he found Henrik sleeping by the fire, which was not yet quite extinguished. The following day they both began to make arrangements for a lengthened stay in the house. But here they found nothing, neither food, household furniture, nor aught else. Nor did they succeed at first in getting any game; and for more then a fortnight they sustained life by boiling and gnawing the flesh from the bones of the reindeer, the seal, and the bear, that lay under the snow, remains from the Russian hunting excursions of the preceding year. Finally, before Christmas they succeeded in killing a reindeer. Their lucifers

were now done, but they lighted a fire by loading their guns with a mixture of which gunpowder formed a part, and firing into old ropes, left behind by the Russians, which they picked asunder and dried. One of the Russian huts they tore down and used as fuel. They had neither axe nor saw, but they split up the fuel by means of a piece of iron, which they took from the keel of the boat, and of which they made, by hammering with stones, a sort of knife. Of some nails, which they also took from the boat, they likewise forged needles by means of stones; they used reindeer sinews for thread, and of the hides they sewed clothes for themselves. They lived in the hut until some time in April. During this time they shot eleven reindeer and a bear, so that they did not actually suffer hunger; but in the middle of April they had powder remaining for only three shots, and they now saw the impossibility of supporting themselves longer at that place, wherefore they determined to go farther south, in order, if possible, to reach Vaygats Island. They went by land along the sea-shore, leaving the boat behind. After the lapse of some days they came to the same Samoyeds with whom the other four of the crew were, and they now remained till the middle of June with the Samoyeds, who gave them the same hospitable treatment as their companions in misfortune. When at the time specified it was determined to fetch the boat from the Russian hut, in order that they might make their way southwards, Johan Andersson, a Swede by birth, declared that he wished to remain with the Samoyeds, and was not willing to accompany the other five on their homeward journey.

The latter now dragged the boat for two days over the ice; but when it became too heavy they had to cut it through the middle and leave a half behind. Of a large sealskin, which they got from the Samoyeds, they made a stern to the other half, which they continued to drag over the ice for three days, until they came to open water. Then they rowed in the

truncated boat ten days, until they reached a fast ice-border at the Vaygats Island, where they again fell in with Samoyeds. Even by these, who could speak neither Russian nor Quaen, and by whom they could with difficulty make themselves understood, they were well received. They remained there eight days and got good entertainment. These Samoyeds had tame reindeer, with which they sent the shipwrecked men on their way southwards, till they fell in with a vessel, with which four returned to Norway. Lars Larsen now did not wish to go home, preferring to remain with the Samoyed family which he had last met with. Samoyed life, however, must not be so pleasant after all, for in a year or two both the men who had remained among the Samoyeds returned home. As a reward for the hospitality which the shipwrecked walrus-hunters had received from the Samoyeds on Gooseland, the Norwegian Government presented them with a number of gifts, consisting of clothes, pearls, breechloaders, with ammunition, &c., which were handed over to them with festive speeches and toasts on the 17th July, 1880. During the entertainment which took place on this occasion on the coast of Novya Zemlaya, toasts were drunk in champagne, and it is said that this liquor was very much relished by the Samoyeds.[1]

As little as Tobiesen could any other walrus-hunter make his way, either in 1872 or 1873, into the Kara Sea, the entrances of which were during these summers blocked by a compact belt of ice, which extended along the east coast of Novaya Zemlya and Vaygats Island to the mainland. In the belief of a large number of experienced walrus-hunters, with whom I have conversed on the subject, this belt of ice was only some few

[1] The statements made here regarding the wintering of Tobiesen and his companions are taken partly from a copy which I caused to be made of his journal, partly from an account of the adventures of the seven hunters, copied from *Finmarksposten* into *Aftonbladet* for 1873, No. 220. Finally, the account of the distribution of presents to the Samoyeds is copied from Norwegian journals into *Aftonbladet* for 1880, No. 197.

nautical miles broad, and it is therefore probable that even in those years there would have been no obstacle to prevent a passage eastwards by this route in autumn.

In 1874, on the contrary, the state of the ice became very favourable, and many walrus-hunters again as formerly sailed in all directions across the Kara Sea, which this year was also visited by an Englishman, Captain J. WIGGINS. None of them, however, penetrated farther to the east or north than Johannesen, Carlsen, Mack, and others had done during the years 1869-70.

It was not until the following year that the North-east voyages took a step forward, important both in a purely geographical as well as a practical point of view, when I succeeded in a walrus-hunting sloop, the *Proeven*, commanded by the walrus-hunting Captain Isaksen, in sailing through Yugor Straits, which were passed on 2nd August, and over the nearly ice-free Kara Sea as far as to the mouth of the Yenisej. The *Proeven* anchored there on the 15th August 1875, in, or more correctly immediately off, the same splendid haven where the *Vega* expedition lay at anchor from the 6th to the 10th August, 1878. Hence I sailed under various difficulties along with Dr. Stuxberg and Dr. Lundström and three men in a Nordland boat, up the river to Saostrovskoj, where we fell in with a steamer, in which we afterwards travelled to Yenisejsk. On leaving Port Dickson I handed over the command to Dr. Kjellman, who along with Dr. Thëel returned by sea to Europe across the Kara Sea and through Matotschkin Schar, which was passed during the return voyage on the 4th to the 11th September.

By this voyage of 1875 I was the first who succeeded in penetrating from the Atlantic Ocean in a vessel to the mouths of the great Siberian rivers. One of the objects which the old North-east voyagers had aimed at was thus at last accomplished, and that in a way that promised to be of immense practical importance for the whole of Siberia. The voyage was also

regarded in that light by leading men in the great empire of the East, and our return journey from Yenisejsk by Krasnojarsk, Tomsk, Omsk, Yekaterineburg, Nischni-Novgorod, Moscow and St. Petersburg, became therefore a journey from *fête* to *fête*. But a number of voices were simultaneously raised, which asserted that the success of the *Proeven* depended on an accidental combination of fortunate circumstances, which would not soon occur again. In order to show that this was not the case, and that I might myself bring the first goods by sea to Siberia, I undertook my second voyage to the Yenisej in 1876, in which I penetrated with the steamer *Ymer*, not only to the mouth of the river, but also up the river to the neighbourhood of Yakovieva in 71° N.L. Hence I returned the same year by sea to Europe.[1] In the gulf of Yenisej a large island was discovered, which I named after Mr. Alexander Sibiriakoff, who defrayed the principal expenses of the expedition. Before starting on this voyage, I visited the Philadelphia Exhibition, and it may perhaps deserve to be mentioned, that leaving New York on the 1st July by one of the ordinary steamers, and going on board my own vessel in Norway, I reached the mouth of the Yenisej on the 15th August, that is to say, in forty-six days.

The same year Captain Wiggins also undertook a voyage to the Yenisej, in which he penetrated with a steamer up the river beyond the labyrinth of islands lying between 70° and 71° N.L. The vessel wintered there, but was lost the following spring at the breaking up of the ice.[2]

[1] The dates of the *Ymer's* voyage are as follows:—Left the coast of Norway on the 26th July; stay at Matotschkin Sound, through which I, on this occasion, steamed into the Kara Sea from the 30th July to the 5th August; arrival at the Yenisej on the 15th August; arrival at the anchorage at Goltschicha on the 16th August; commenced the return voyage on the 1st September, in the course of it passed Matotschkin Schar on the 7th September.

[2] Of Captain Wiggins' voyage I know only that his original destination

The voyages of the *Proeven* and the *Ymer* led to several purely commercial voyages to the Yenisej and the Ob, of which however I can here with the greatest brevity mention only the following:

The Swedish steamer *Fraser*, commanded by the German Captain DALLMANN, after having been fitted out at Gothenburg

JOSEPH WIGGINS.

on Sibiriakoff's account, sailed in 1877 with a cargo from Bremen to the Yenisej and back. The vessel left Hammerfest on the 9th August, arrived at Goltschicha on the 21st August, commenced the return voyage on the 14th September, and on the 24th of the same month was back at Hammerfest.

was the Ob, but that on account of currents and shoals which he encountered at the mouth of this river, he altered his plan, and reached the Yenisej in the beginning of September.

The steamer *Louise* commanded by Captain DAHL, with a cargo of iron, olive oil, and sugar, the same year made the first voyage from England to Tobolsk, starting from Hull on the 18th July and arriving at Tobolsk on the 20th September.[1]

Captain SCHWANENBERG sailed in a half-decked sloop, the *Utrennaja Saria*, from the Yenisej to Europe. To what has

DAVID IVANOVITSCH SCHWANENBERG,
Born in Courland in 1831.

been already said of this voyage, I may here add a few words more.

During the inundation in the spring of 1877, which compelled the mate Nummelin to betake himself for eight days to the roof of the fragile dwelling in which he had passed the

[1] *Deutsche Geographische Blätter*, Bremen, 1870, i. p. 216, and ii. p. 35.

winter, the Yenisejsk-built vessel, the *Aurora* (or *Sewernoe Sianie*) was lost. Schwanenberg, who soon afterwards came to the neighbourhood, succeeded in purchasing from an Englishman, Mr. SEEBOHM,[1] another little vessel, which was also built at Yenisejsk by Mr. Boiling for the purpose of transporting thither the goods which I had carried in the *Ymer* to Korepovskoj, a *simovie* on the bank of the Yenisej in 71° 19′ N.L. The goods however had been taken up the river by a steamer, on which account the vessel was sold by Boiling to Mr. Seebohm, who made an excursion in it to the lower courses of the Yenisej for ornithological researches. He named the vessel the *Ibis*. When Mr. Seebohm no longer required it, there was at first a proposal that it should be taken over by Captain Wiggins, who, as has been already stated, had the year before come to the Yenisej with a small steamer, which wintered at the islands in the river, and had now stranded during the breaking up of the ice. He wished to carry his men on the *Ibis* either home or to the Ob, but the English seamen declared that they would not for all the world's honour and riches sail in that vessel. Schwanenberg had thus an opportunity of purchasing the vessel, whose name he altered to the *Utrennaja Saria* (the *Dawn*), and to the surprise of all experienced seamen he actually made a successful passage to Norway. The vessel was then towed along the coast to Gothenburg, and through the Göta Canal to Stockholm, and finally crossed the Baltic to St. Petersburg.

On the 13th August Schwanenberg hoisted the Russian flag on his little vessel. During his outward passage he met, in the mouth of the Yenisej, Sibiriakoff's steamer the *Fraser*, Captain Dallmann, who in vain endeavoured to dissuade him from prosecuting the adventurous voyage. He anchored at Beli Ostrov on the 24th August, passed the Kara Port on the 30th August, and reached Vardoe on the 11th September. The *Utrennaja Saria* arrived at Christiania on the 31st October, at Gothenburg on the 15th November, passed Motala on the 20th, reached

Stockholm on the 23rd November and St. Petersburg on the 3rd December. Everywhere in Scandinavia the gallant seamen met with the heartiest reception. Their vessel was the first that sailed from the town of Yenisejsk to Europe, and is still, when this is being written, the only one.

GUSTAF ADOLF NUMMELIN.

Born at Viborg in 1853.

The *Dawn* is 56 feet long, 14 feet beam, and draws 6 feet of water. Aft there is a little cabin in which there is scant space for three men. Cooking is done in the fore. The cargo consisted of a small quantity of graphite, fish, furs, and other samples of the products of Siberia.

The vessel was manned by Captain Schwanenberg, the mates Nummelin and Meywaldt, and two exiled criminals, who in this unexpected way returned to their native country. I take it for

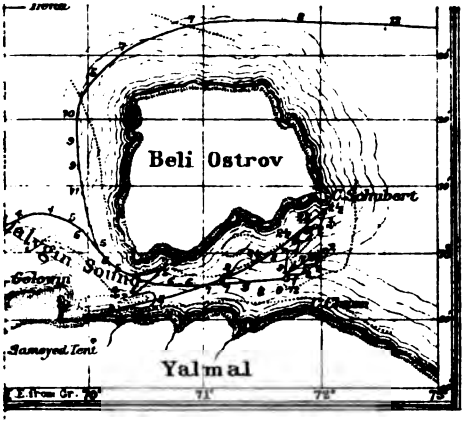
THE SLOOP UTRENNAJA SARIA.

granted that by the rare nautical exploit they took part in, they there won forgiveness for former offences.

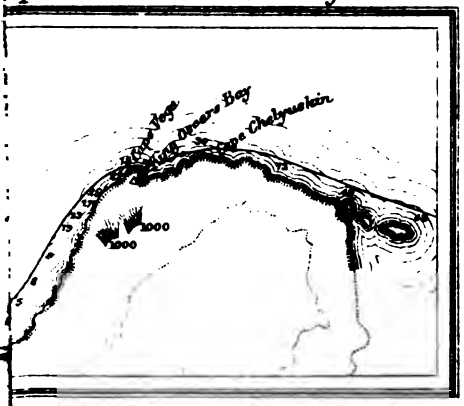
CHAPTER VII.

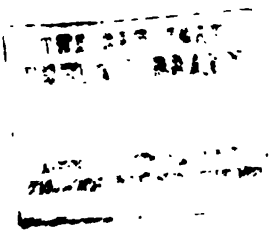
Departure from Port Dickson—Landing on a rocky island east of the Yenisej—Self-dead animals—Discovery of crystals on the surface of the drift-ice—Cosmic dust—Stay in Actinia Bay—Johannesen's discovery of the island Ensamheten—Arrival at Cape Chelyuskin—The natural state of the land and sea there—Attempt to penetrate right eastwards to the New Siberian Islands—The effect of the mist—Abundant dredging-yield—Preobraschenie Island—Separation from the *Lena* at the mouth of the river Lena.

WHEN on the morning of the 9th August the *Fraser* and *Express* sailed for the point higher up the river where their cargo was lying, the *Vega* and the *Lena* were also ready to sail. I, however, permitted the vessels to remain at Port Dickson a day longer, in order to allow Lieutenant Bove to finish his survey, and for the purpose of determining astronomically, if possible, the position of this important place. In consequence of a continuous fog, however, I had as little opportunity of doing so on this occasion as during the voyage of 1875, which serves to show of what sort the weather is during summer at the place where the warm water of the Yenisej is poured into the Arctic Ocean. It was thus not until the morning of the 10th August that the *Vega* and the *Lena* weighed anchor in order to continue their voyage. The course was shaped for the most westerly of the islands, which old maps place off the estuary-bay of the Pjäsina, and name Kammenni Ostrova (Stone Islands), a name which seems to indicate that in their natural state they correspond to the rocky islands about Port



Map of CAPE CHELYUSKIN by G.Bove.





Dickson. The sky was hid by mist, the temperature of the air rose to + 10°·4 C.; that of the water was at first + 10°, afterwards + 8°; its salinity at the surface of the sea was inconsiderable. No ice was seen during the course of the day. Favoured by a fresh breeze from the south-east, the *Vega* could thus begin her voyage with all sail set. Small rocky islands, which are not to be found on the chart, soon reminded us of the untrustworthiness of the maps. This, together with the prevailing fog, compelled Captain Palander to sail forward with great caution, keeping a good outlook and sounding constantly. Warm weather and an open sea were also favourable for the next day's voyage. But the fog now became so dense, that the *Vega* had to lie-to in the morning at one of the many small islands which we still met with on our way.

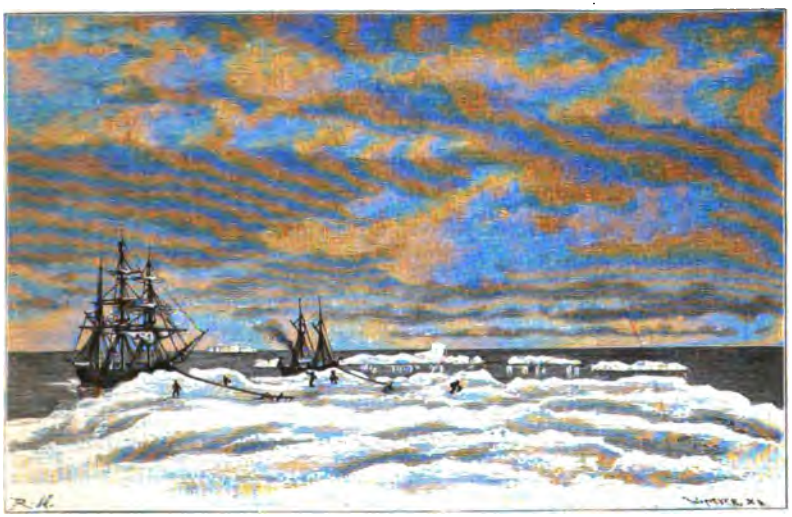
Dr. Kjellman, Dr. Almquist, Lieutenant Nordquist, and I, landed here. The bare and utterly desolate island consisted of a low gneiss rock, rising here and there into cliffs, which were shattered by the frost and rather richly clothed with lichens. On the more low-lying places the rock was covered with a layer of gravel, which, through drying and consequent contraction, had burst into six-sided figures, mostly from 0·3 to 0·5 metre in diameter. The interior of the figures was completely bare of vegetation, only in the cracks there was to be seen an exceedingly scanty growth of stunted mosses, lichens, and flowering plants. Of the last-named group there were found fifteen species,[1] which could with success, or more correctly without

[1] Namely, according to Dr. Kjellman's determination, the following:

Saxifraga oppositifolia L.
„ rivularis L.
„ cæspitosa L.
Cardamine bellidifolia L.
Cochlearia fenestrata R. Br.
Ranunculus hyperboreus Rottb.
Stellaria Edwardsii R. Br.
Cerastium alpinum L.
Alsine macrocarpa Fenzl.
Sagina nivalis Fr.
Salix polaris Wg.
Glyceria vilfoidea (Ands.) Th. Fr.
Catabrosa algida (Sol.) Fr.
Aira cæspitosa L.
Juncus biglumis L.

succumbing, survive the struggle for existence on the little poor archipelago, protected by no mountain heights, from the storms of the Polar Sea; but of these species, perhaps a couple seldom develop any flowers. The mosses, too, were in great part without fruit, with the exception of those which grew on the margin, formed of hard clay covered with mud, of a pool, filled with brackish water and lying close to the sea-margin. A large number of pieces of driftwood scattered round this pool showed that the place was occasionally overflowed with sea-water, which thus appears to have been favourable to the development of the mosses. Of lichens Dr. Almquist found a number of species, well developed, and occurring in comparative abundance. On the contrary, the sea, although the surrounding rocky islands indicated a good bottom for algæ, was so completely destitute of the higher algæ, that only a single microscopic species was found by Dr. Kjellman. No mammalia were seen, not even the usual inhabitant of the desolate rocky islands of the Polar Sea, the Polar bear, who, in regions where he has not made acquaintance with the hunter's ball or lance, in secure reliance on his hitherto unvanquished might, seldom neglects to scrutinise the newly arrived guests from the tops of high rocks or ice-blocks. We saw here only six species of birds. The first of these that attracted our attention was the snow-bunting, which had left the more fertile mountain heights of the south to choose this bare and desolate island in the Arctic Ocean for its breeding-place, and now fluttered round the stone mounds, where it had its nest, with unceasing twitter, as if to express its satisfaction with its choice. Further, two species of waders, *Tringa maritima* and *Phalaropus fulicarius*, were observed running restlessly about the beach to collect their food, which consists of insects. The birds that were killed often had their crops full of the remains of insects, although living at a place where the naturalist has to search for hours to find a dozen gnats or their equals in size, a circumstance that tells very favourably for these

birds' powers of vision, of locomotion, and of apprehension. It is difficult in any case to understand what it is that attracts this insectivorous bird to one of the regions that is poorest in insect life in the whole world. The glaucous gulls' plunderer, the skua, and its chastiser the bold tern, were also observed, as were a few barnacle geese. On the other hand, no eiders were met with. All the birds named occurred only in inconsiderable numbers, and



THE VEGA AND LENA MOORED TO AN ICE-FLOE.

On the morning of the 12th August, 1878. (After a drawing by O. Nordquist.)

there was nothing found here resembling the life which prevails on a Spitzbergen fowl-island. Finally, it may be mentioned that Lieutenant Nordquist found under stones and pieces of drift-wood a few insects, among them a beetle (a *staphylinid*). Dr. Stuxberg afterwards found a specimen of the same insect species at Cape Chelyuskin itself. No beetle is found on Spitzbergen, though the greater portion of that group of islands is, in respect of climate, soil, and vegetation, much better favoured

than the region now in question. This seems to me to show that the insect fauna of Spitzbergen, exceedingly inconsiderable and limited in numbers as it is, has migrated thither in comparatively recent times, and in how high a degree the migration of beetles is rendered difficult by their inability to pass broad expanses of water.

By afternoon the air had again cleared somewhat, so that we could sail on. A piece of ice was seen here and there, and at night the ice increased for a little to an unpleasant extent. Now, however, it did not occur in such quantity as to prove an obstacle to navigation in clear weather or in known waters.

On the 12th August we still sailed through considerable fields of scattered drift-ice, consisting partly of old ice of large dimensions, partly of very rotten year's ice. It formed, however, no serious obstacle to our advance, and nearer the shore we would probably have had quite open water, but of course it was not advisable to go too near land in the fog and unknown waters, without being obliged. A large number of fish (*Gadus polaris*) were seen above the foot of a large block of ground ice, near which we lay-to for some hours. Next day we saw near one of the islands, where the water was very clear, the sea-bottom bestrewed with innumerable fish of the same species. They had probably perished from the same cause, which often kills fish in the river Ob in so great numbers that the water is infected, namely, from a large shoal of fish having been enclosed by ice in a small hole, where the water, when its surface has frozen, could no longer by absorption from the air replace the oxygen consumed, and where the fish have thus been literally drowned. I mention this inconsiderable *find* of some self-dead fish, because self-dead vertebrate animals, even fish, are found exceedingly seldom. Such *finds* therefore deserve to be noted with much greater care than, for instance, the occurrence of animal species in the neighbourhood of places where they have been seen a thousand times before. During my nine

expeditions in the Arctic regions, where animal life during summer is so exceedingly abundant, the case just mentioned has been one of the few in which I have found remains of recent vertebrate animals which could be proved to have died a natural death. Near hunting-grounds there are to be seen often enough the remains of reindeer, seals, foxes, or birds that have died from gunshot wounds, but no self-dead Polar bear, seal, walrus, white whale, fox, goose, auk, lemming or other vertebrate. The Polar bear and the reindeer are found there in hundreds, the seal, walrus, and white whale in thousands, and birds in millions.[1] These animals must die a "natural" death in untold numbers. What becomes of their bodies? Of this we have for the present no idea, and yet we have here a problem of immense importance for the answering of a large number of questions concerning the formation of fossiliferous strata. It is strange in any case that on Spitzbergen it is easier to find vertebræ of a gigantic lizard of the Trias, than bones of a self-dead seal, walrus, or bird, and the same also holds good of more southerly inhabited lands.

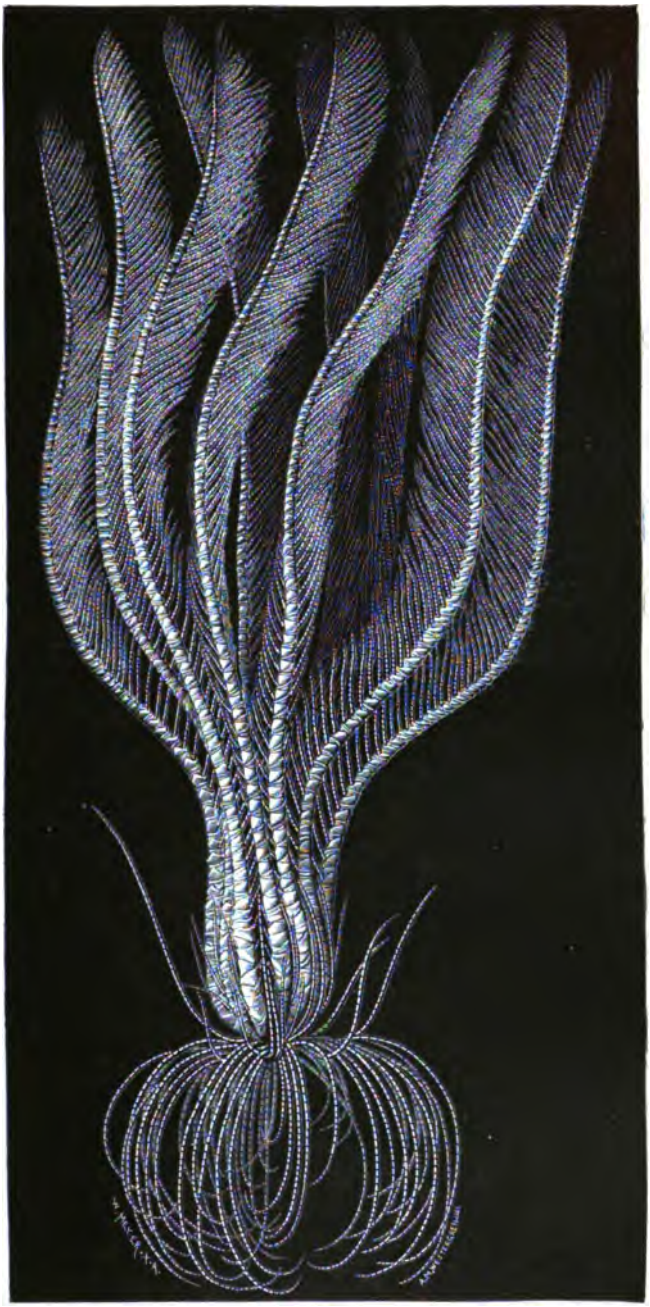
On the 13th August we again sailed past a large number of small rocks or islands. The sea was at first pretty free of ice, but was afterwards bestrewed with even, thin pieces of drift-ice, which were not forced up on each other, and thus had not been exposed in winter to any ice-pressure. This ice did not cause any inconvenience to the navigation, but at the same time all was wrapt in a very close mist, which soon compelled us to anchor near the shore in a little bay. I endeavoured without success to determine the position of the place by astronomical observations. Along the shore there still remained nearly everywhere a pretty high snow and ice-foot, which in the fog

[1] I can remember only one other instance of finding self-dead vertebrate animals, viz. when in 1873, as has already been stated (p.110), I found a large number of dead rotges on the ice at the mouth of Hinloopen Strait.

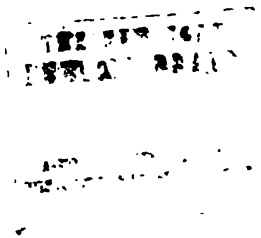
presented the appearance of immense glaciers. The land besides was free of ice. In respect of its geological formation and its animals and plants it resembled completely the island I have just described. But the sea-water here was clear and salt, and the dredging therefore yielded to Dr. Kjellman some large algæ, and to Dr. Stuxberg a large number of marine evertebrates.

When the fog lightened, we immediately steamed on, but we had scarcely got to sea before we were again wrapped in so close a fog that we were compelled to lie-to for the night beside a large piece of drift-ice. The hempen tangles were used, and brought up a very abundant yield of large, beautiful animal forms, a large number of asterids, Astrophyton, Antedon, &c. There was besides made here an exceedingly remarkable, and to me still, while I write, a very enigmatical *find*.

For several years back I have been zealous for the examination of all substances of the nature of dust which fall to the surface of the earth with rain or snow, and I have proved that a portion of them is of cosmic origin. This inconsiderable fall of dust is thus of immense importance for the history of the development of our globe, and we regard it, besides, with the intense interest which we inevitably cherish for all that brings us an actual experience regarding the material world beyond our globe. The inhabited countries of the earth, however, are less suitable for such investigations, as the particles of cosmic dust falling down here in very limited quantity can only with difficulty be distinguished from the dust of civilization, arising from human dwellings, from the offal of industry, from furnaces and the chimneys of steam-engines. The case is quite different on the snow and ice-fields of the High North, remote from human habitations and the tracks of steamers. Every foreign grain of dust can here be easily distinguished and removed, and there is a strong probability that the offal of civilization is here nearly wholly wanting. It is self-evident from this that I would not be disposed to neglect the first opportunity

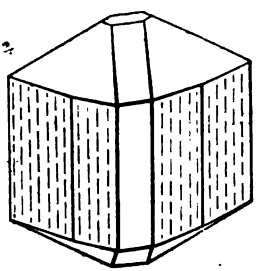


HAIRSTAR FROM THE TAIMUR COAST.
Antedon Eschrichtii, J. MÜLLER.
Three-fifths of the natural size.



for renewed investigations in the direction indicated, which our involuntary rest at the drift-ice field offered.

Immediately after the *Vega* lay-to, I therefore went down on the ice in order to see whether here too some such metalliferous dust, as I had before found north of Spitzbergen, was not to be found on the surface of the ice. Nothing of the kind, however, was to be seen. On the other hand, Lieutenant Nordquist observed small yellow specks in the snow, which I asked him to collect and hand over for investigation to Dr. Kjellman. For I supposed that the specks consisted of diatom ooze. After examining them Dr. Kjellman however declared that they did not consist of any organic substance, but of crystallised grains of sand. I too now examined them more closely, but unfortunately not until the morning after we had left the ice-field, and then found that the supposed ooze consisted of pale yellow crystals (not fragments of crystals) without mixture of foreign matter. The quantity of crystals, which were obtained from about three litres of snow, skimmed from the surface of the snow on an area of at most 10 square metres, amounted to nearly 0·2 gram. The crystals were found only near the surface of the snow, not in the deeper layers. They were up to 1 mm. in diameter, had the appearance shown in the accompanying woodcut, and appeared to belong to the rhombic system, as they had one perfect cleavage and formed striated prisms terminated at either end by truncated pyramids. Unfortunately I could not make any actual measurements of them, because after being kept for some time in the air they weathered to a white non-crystalline powder. They lay, without being sensibly dissolved,



FORM OF THE CRYSTALS
Found on the ice off the Taimur coast.
Magnified thirty to forty times.

for a whole night in the water formed by the melting of the snow. On being heated, too, they fell asunder into a tasteless white powder. The white powder, that was formed by the weathering of the crystals, was analysed after our return—21 months after the discovery of the crystals—and was found to contain only carbonate of lime.

The original composition and origin of this substance appears to me exceedingly enigmatical. It was not common carbonate of lime, for the crystals were rhombohedral and did not show the cleavage of calcite. Nor can there be a question of its being arragonite, because this mineral might indeed fall asunder "of itself," but in that case the newly-formed powder ought to be crystalline. Have the crystals originally been a new hydrated carbonate of lime, formed by crystallising out of the sea-water in intense cold, and then losing its water at a temperature of 10° or 20° above the freezing-point? In such a case they ought not to have been found on the surface of the *snow*, but lower down on the surface of the *ice*. Or have they fallen down from the inter-planetary spaces to the surface of the earth, and before crumbling down have had a composition differing from terrestrial substances in the same way as various chemical compounds found in recent times in meteoric stones? The occurrence of the crystals in the uppermost layer of snow and their falling asunder in the air, tell in favour of this view. Unfortunately there is now no possibility of settling these questions, but at all events this discovery is a further incitement to those who travel in the High North to collect with extreme care, from snow-fields lying far from the ordinary routes of communication, all foreign substances, though apparently of trifling importance.

As this question can be answered with the greatest ease and certainty by investigations in the Polar regions, I shall here, for the guidance of future travellers, enumerate some discoveries of a like nature which have been made by me, or at my instance.

1. In the beginning of December, 1871, there happened at Stockholm an exceedingly heavy fall of snow, perhaps the heaviest which has taken place in the memory of man. Several persons perished in the snow in the immediate neighbourhood of Stockholm. During the last days of the snowfall I had about a cubic metre of snow collected and melted in a vessel. It left a residue of black powder, which contained grains of metallic iron that were attracted by the magnet.

2. In the middle of March, 1872, a similar investigation was made by my brother, KARL NORDENSKIOLD, in a remote forest settlement, Evois, in Finland. Here, too, was obtained, on the melting of the snow, a small residuum, consisting of a black powder containing metallic iron.

SECTION OF THE UPPER PART OF THE SNOW ON A DRIFT-ICE FIELD IN 80° N.L.
One-half the natural size.

3. On the 8th August and 2nd September of the same year, I examined, north of Spitzbergen, in 80° N.L., and 13° to 15° E.L., the layer of snow that there covered the ice. The nature of this layer is shown by the accompanying woodcut, in which 1, is new-fallen snow; 2, a layer of hardened old snow, eight mm. in thickness; 3, a layer of snow conglomerated to a crystalline granular mass; and 4, common granular hardened snow. Layer 3 was full of small black grains, among which were found numerous metallic particles that were attracted by the magnet, and were found to contain iron, cobalt, and possibly nickel also.

4. On the melting of 500 gram. hail, which fell in Stockholm in the autumn of 1873, similar metallic particles containing cobalt (nickel) were obtained, which, in this case, might possibly have come from the neighbouring roofs, because the hail was collected in a yard surrounded by houses roofed with sheet-iron

painted red. The black colour of the metallic particles enclosed in the hail, their position in the hail, and finally, the cobalt they contained, however, indicate in this case too, a quite different origin.

5. In a dust (kryokonite), collected on the inland ice of Greenland in the month of July, 1870, there were also found mixed with it grains of metallic iron, containing cobalt. The main mass consisted of a crystalline, double-refracting silicate, drenched through with an ill-smelling organic substance. The dust was found in large quantities at the bottom of innumerable small holes in the surface of the inland ice. This dust could scarcely be of volcanic origin, because by its crystalline structure it differs completely from the glass-dust that is commonly thrown out of volcanoes, and is often carried by the wind to very remote regions, as also from the dust which, on the 30th March, 1875, fell at many places in the middle of Scandinavia, and which was proved to have been thrown out by volcanoes on Iceland. For, while kryokonite consists of small angular double-refracting crystal-fragments without any mixture of particles of glass, the volcanic Haga-dust[1] consists almost wholly of small microscopic glass bubbles that have no action on the polarisation-planes of the light that passes through them.

Similar investigations have since been made, among others,

[1] I use this name because the ash-rain of March 1875 was first observed at Haga palace near Stockholm, and thus at the outer limit of the known area of distribution of the dust. It was first through the request which in consequence of this observation was published in the newspapers, that communications regarding singular observations in other quarters should be sent to the Swedish Academy of Sciences, that it became known that a similar rain had about the same time taken place over a very large part of middle Sweden and Norway. The dust however did not fall evenly, but distributed in spots, and at several different times. The distance from Stockholm of the volcanoes, where the outbreak took place, is nearly 2000 kilometres.

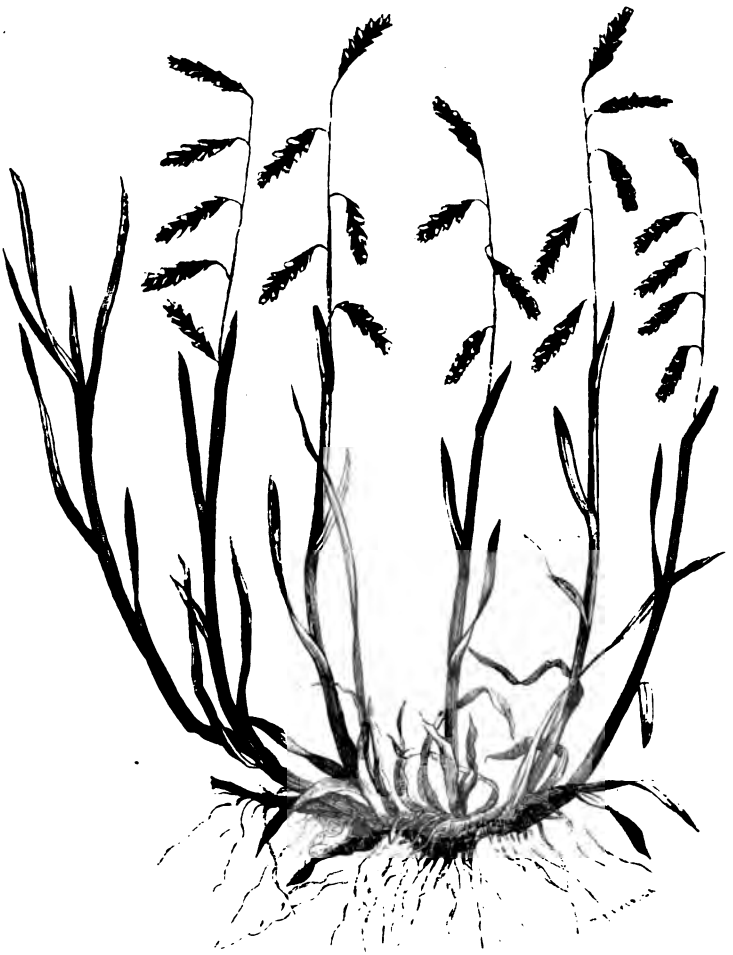
by M. TISSANDIER in Paris, and during NARES' English Polar Expedition.

It may appear to many that it is below the dignity of science to concern one's self with so trifling an affair as the fall of a small quantity of dust. But this is by no means the case. For I estimate the quantity of the dust that was found on the ice north of Spitzbergen at from 0·1 to 1 milligram per square metre, and probably the whole fall of dust for the year far exceeded the latter figure. But a milligram on every square metre of the surface of the earth amounts for the whole globe to five hundred million kilograms (say half a million tons)! Such a mass collected year by year during the geological ages, of a duration probably incomprehensible by us, forms too important a factor to be neglected, when the fundamental facts of the geological history of our planet are enumerated. A continuation of these investigations will perhaps show, that our globe has increased gradually from a small beginning to the dimensions it now possesses; that a considerable quantity of the constituents of our sedimentary strata, especially of those that have been deposited in the open sea far from land, are of cosmic origin; and will throw an unexpected light on the origin of the fire-hearths of the volcanoes, and afford a simple explanation of the remarkable resemblance which unmistakably exists between plutonic rocks and meteoric stones.[1]

On the 14th August, when the fog had lightened a little, we got up steam, but were soon compelled to anchor again in a bay running into Taimur Island from the north side of Taimur Sound, which I named Actinia Bay, from the large number of actinia which the dredge brought up there. It is, besides, not

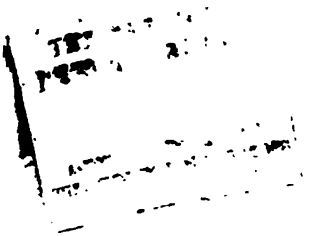
[1] Namely, by showing that the principal material of the plutonic and volcanic rocks is of cosmic origin, and that the phenomena of heat, which occur in these layers, depend on chemical changes to which the cosmic sediment, after being covered by thick terrestrial formations, is subjected.

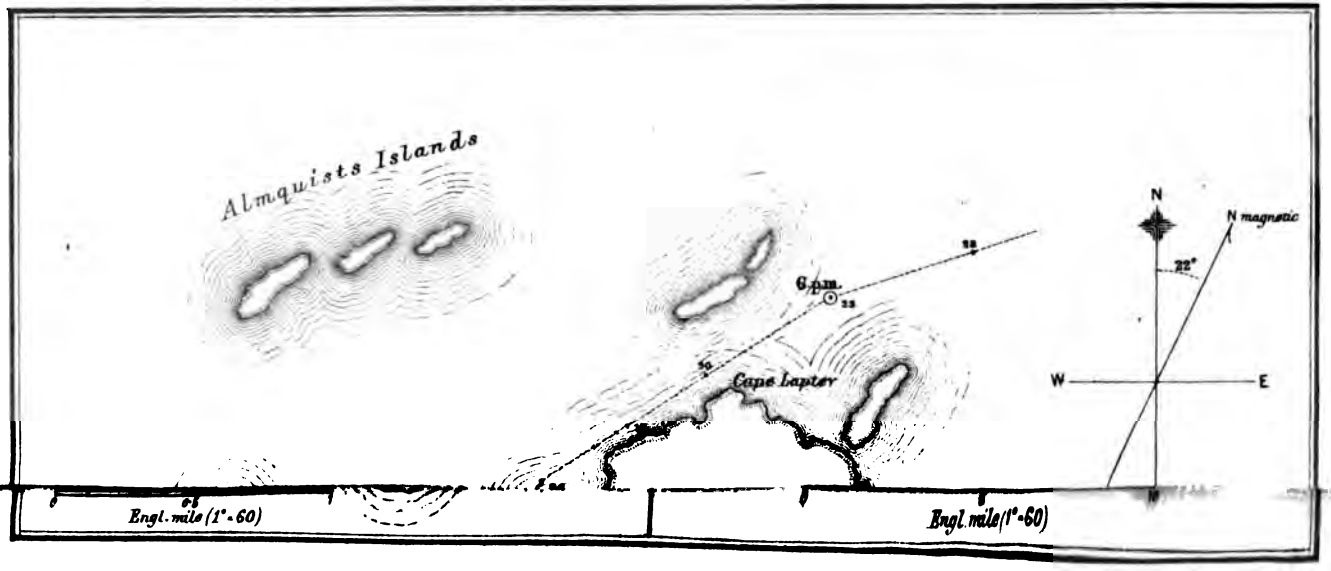
the only place in the Kara Sea which might be named from the evertebrate life prevailing there, so unexpectedly abundant.



GRASS FROM ACTINIA BAY.
Pleuropogon Sabini, R. BR.

Unfavourable weather detained us in Actinia Bay, which is a good and well-protected haven, till the 18th August,

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during which time excursions were made in various directions, among others farther into Taimur Sound, where a variable strong current was found to prevail. The Sound is too shallow to be passed through by large vessels. The rocks round Taimur Sound consist of gneiss strata, which form low ridges that have been so shattered by the frost that they have been converted into immense lichen-clad stone mounds. Between these stretch extensive valleys and plains, now free of snow, if we except a snow-drift remaining here and there in the hollows. The plains were all covered with a very green continuous vegetation, which however on a closer examination was found to be not a true turf, but a mixture of grasses, allied plants, and a large number of different kinds of mosses and lichens. Actual flowers were found here only sparingly.[1] In this respect the coast *tundra* shows a remarkable difference from the coast lands on Vaygats Island and Novaya Zemlya. On the other hand, the abundance of luxuriant lichens and mosses was striking. The mosses along the beach and the borders of the snow-drifts remaining here and there bore fruit in abundance. Animal life

[1] Dr. Kjellman has given the following list of the flowering plants collected by him in this region :—

Cineraria frigida RICHARDS.
Potentilla emarginata PURSH.
Saxifraga stellaris L. f. comosa.
„ nivalis L.
„ cernua L.
„ rivularis L.
Chrysosplenium alternifolium L.
Cardamine bellidifolia L.
Draba corymbosa R. BR.
Papaver nudicaule L.
Ranunculus pygmæus WG.
„ hyperboreus ROTTB.
„ sulphureus SOL.
Stellaria Edwardsii R. BR.
Cerastium alpinum L.
Alsine macrocarpa FENZL.
Salix polaris WG.
Poa arctica R. BR.
Arctophila pendulina (LÆST.) ANDS.
Catabrosa algida (Sol.) FR.
Colpodium latifolium R. BR.
Dupontia Fisheri R. BR.
Pleuropogon Sabini R. BR.
Aira cæspitosa L.
Hierochloa pauciflora R. BR.
Calamagrostis lapponica (WG.) HN.
Alopecurus alpinus SM.
Eriophorum angustifolium ROTH.
„ Scheuchzeri HOPPE.
Carex aquatilis WG.
„ rigida GOOD.
Juncus biglumis L.
Luzula hyperborea R. BR.
„ arctica BL.

on land was scanty; some few reindeer were seen, a mountain fox was killed, and a lemming caught.

Only the following birds were seen: owls (*Strix nyctea*) rather numerous, of which one was killed; a species of falcon, which was hunted unsuccessfully; snow buntings, breeding very generally in the stone mounds; a covey of snow ptarmigan, of which some young birds were shot; six species of waders, the most common birds of the region, of which a large number were shot; two kinds of gulls (*Larus glaucus* and *tridactylus*); *Lestris parasitica* and *Buffonii*, the latter the more common of the two; *Anser bernicla*, very common; and finally the long-tailed duck (*Harelda glacialis*) in great flocks swimming in the Sound. Bird life, viewed as a whole, was still scanty here, in comparison with that which we were accustomed to see in the northern regions west of Novaya Zemlya.

In the sea the higher animal life was somewhat more abundant. A walrus had been seen during the passage from the Yenisej, and on the ice drifting about in the Sound a number of seals, both *Phoca barbata* and *Phoca hispida*, were observed. This gave rise to the supposition that at the sea-bottom animal life was richer, which was also confirmed by the dredging yield. Nowhere was seen on our arrival any trace of man, but a cairn now indicates the place, off which the *Vega* and the *Lena* were anchored.

In this sea never before visited by any vessel, however, we were nearly coming in contact with a countryman. For while we lay at anchor in Taimur Sound, Captain Edward Johannesen came into the neighbourhood of the same place with his sailing vessel *Nordland* from Tromsoe. He had left Norway on the 22nd May 1878, had come to Gooseland in Novaya Zemlya on the 6th June, and had reached the northernmost point of that island on the 22nd July. Here loud thunder was heard on the 26th July. On the 10th August he steered eastwards from Novaya Zemlya across the Kara Sea between 76° and 77° N.L. in open

water. On the 16th he had the Taimur country in sight. Here he turned, and steered first to the west, then to the north. In 77° 31′ N.L. and 86° E.L. from Greenwich he discovered and circumnavigated a new island, which was named "Ensamheten" (Solitude). The island was free of snow, but not overgrown with grass. The animals that were seen were some bears and bearded seals, terns, fulmars, ivory gulls, flocks of black guillemots, and a "bird with a rounded tail and long bill," probably some wader. On the north-east side of the island a strong northerly current prevailed. The remote position and desolate appearance of the island gave occasion to the name proposed by Johannesen. Hence Johannesen sailed with a great bend to the north, which brought him to 78° N.L., back to the northern extremity of Novaya Zemlya, and thence on the 12th September to Norway. During the return voyage across the Kara Sea also scarcely any ice was met with.[1]

An exceedingly persistent fog prevailed during the whole of the time we remained here, but at last on the 18th it lightened a little. We immediately weighed anchor and steamed along the western shore of Taimur Island. It is surrounded by a large number of islands that are not given on the map, and possibly Taimur Island itself is divided by sounds into several parts. During our voyage, however, the fog that was still very close hindered us from mapping, otherwise than in a very loose way, the islands, large and small, between and past which the *Vega* searched for a passage. So much we could in any case see, that the northern extremity of Taimur Island does not run so far north as the common maps show.

Ice we met with only in small quantity, and what we saw was very rotten fjord or river ice. I scarcely believe that in the course of the day we met with a single piece of ice large enough to flense a seal upon. We had as yet seen no true old drift-ice

[1] *H. Mohn.* Die Insel Einsamkeit, &c., with a map (Petermann's *Mittheilungen*, 1879, p. 57).

such as is to be met with north of Spitzbergen. In respect to the nature of the ice, there is a complete dissimilarity between the Kara Sea and the sea north and east of Spitzbergen. Another striking difference is the scarcity of warm-blooded animals which prevails in this region, hitherto exempted from all hunting. In the course of the day we had not seen a single bird—something which never before happened to me during a summer journey in the Arctic regions—and scarcely any seals.

On the 19th August we continued to sail and steam along the coast, mostly in a very close fog, which only at intervals dispersed so much that the lie of the coast could be made out. In order that they might not be separated, both vessels had often to signal to each other with the steam-whistle. The sea was bright as a mirror. Drift-ice was seen now and then, but only in small quantity and very rotten; but in the course of the day we steamed past an extensive unbroken ice-field, fast to the land, which occupied a bay on the west side of the Chelyuskin peninsula. The ice, of which it consisted, appeared in the mist immensely rough and high, although in fact it was nearly as rotten as that of which the narrow belts of ice were formed which we now and then met with out at sea.

The fog prevented all view far across the ice, and I already feared that the northernmost promontory of Asia would be so surrounded with ice that we could not land upon it. But soon a dark, ice-free cape peeped out of the mist in the north-east. A bay open to the north here cuts into the land, and in this bay both the vessels anchored on the 19th August at 6 o'clock p.m.

We had now reached a great goal, which for centuries had been the object of unsuccessful struggles. For the first time a vessel lay at anchor off the northernmost cape of the old world. No wonder then that the occurrence was celebrated by a display of flags and the firing of salutes, and, when we returned from our excursion on land, by festivities on board, by wine and toasts.

As on our arrival at the Yenisej, we were received here too by

THE VEGA AND LENA SALUTING CAPE CHELYUSKIN.
(After a drawing by A. Hovgaard.)

a large Polar bear, who, even before the vessel anchored, was seen to go backwards and forwards on the beach, now and then turning his glance and his nose uneasily out to sea in order to investigate what remarkable guests had now for the first time come to his kingdom. A boat was put off to kill him. Brusewitz was the chosen shot; but on this occasion the bear took care not to form any closer acquaintance with our guns. The firing

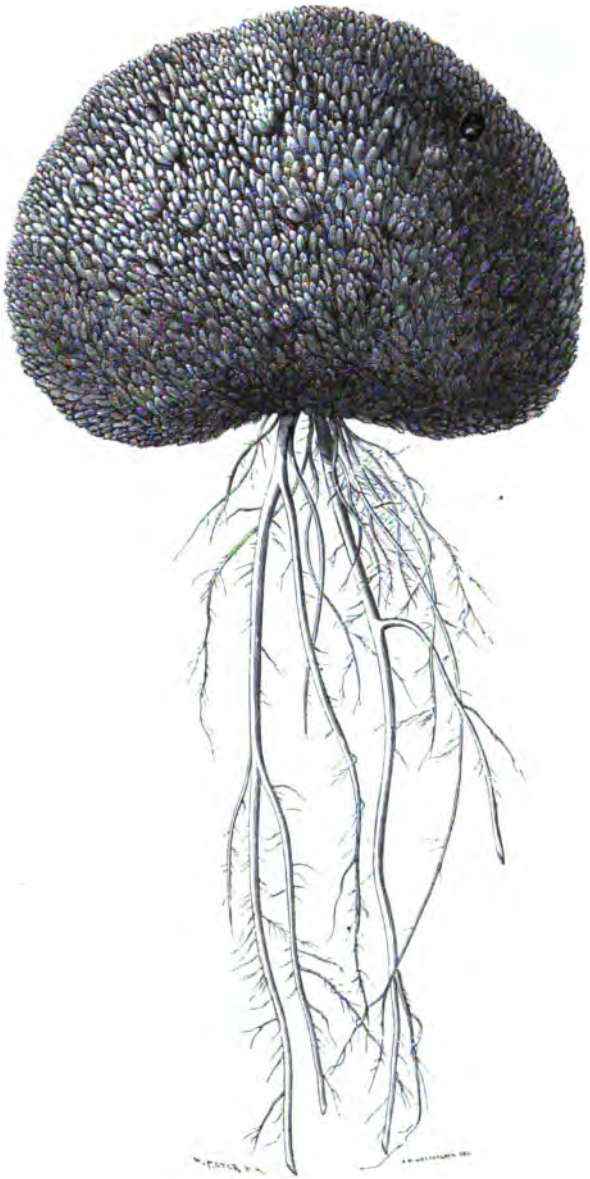
VIEW AT CAPE CHELYUSKIN DURING THE STAY OF THE EXPEDITION.
(After a drawing by A. Hovgaard.)

of the salute put him so thoroughly to flight, that he did not, as bears are wont, return the following day.

The north point of Asia forms a low promontory, which a bay divides into two, the eastern arm projecting a little farther to the north than the western. A ridge of hills with gently sloping sides runs into the land from the eastern point, and appears

within sight of the western to reach a height of 300 metres. Like the plains lying below, the summits of this range were nearly free of snow. Only on the hill-sides or in deep furrows excavated by the streams of melted snow, and in dales in the plains, were large white snow-fields to be seen. A low ice-foot still remained at most places along the shore. But no glacier rolled its bluish-white ice-masses down the mountain sides, and no inland lakes, no perpendicular cliffs, no high mountain summits, gave any natural beauty to the landscape, which was the most monotonous and the most desolate I have seen in the High North.

As on the island off which we lay at anchor on the 11th August, the ground was everywhere burst asunder into more or less regular six-sided figures, the interior of which was usually bare of vegetation, while stunted flowering-plants, lichens and mosses, rose out of the cracks. At some few places, however, the ground was covered with a carpet of mosses, lichens, grasses and allied plants, resembling that which I previously found at Actinia Bay. Yet the flowering-plants were less numerous here, and the mosses more stunted and bearing fruit less abundantly. The lichen flora was also, according to Dr. Almquist's examination, monotonous, though very luxuriant. The plants were most abundant on the farthest extremity of the Cape. It almost appeared as if many of the plants of the Taimur country had attempted to migrate hence farther to the north, but meeting the sea, had stood still, unable to go farther and unwilling to turn. For here Dr. Kjellman found on a very limited area nearly all the plants of the region. The species which were distinctive of the vegetation here were the following: *Saxifraga oppositifolia* L., *Papaver nudicaule* L., *Draba alpina* L., *Cerastium alpinum* L., *Stellaria Edwardsii* R. Br., *Alsine macrocarpa* Fenzl., *Aira cæspitosa* L., *Catabrosa algida* (Sol.) Fr., and *Alopecurus alpinus* Sm. The following plants occurred less frequently: *Eritrichium villosum* Bunge, *Saxifraga nivalis* L.,



DRABA ALPINA L., FROM CAPE CHELYUSKIN.
Natural size.

S. cernua L., *S. rivularis* L., *S. stellaris* L., *S. cæspitosa* L., *S. flagellaris* WILLD., *S. serpyllifolia* PURSH., *Cardamine bellidifolia* L., *Cochlearia fenestrata* R. BR., *Oxyria digyna* (L.) HILL., *Salix polaris* WG., *Poa flexuosa* WG., and *Luzula hyperborea* R. BR. There were thus found in all only twenty-three species of inconsiderable flowering-plants, among them eight species belonging to the Saxifrage family, a sulphur-yellow poppy, commonly cultivated in our gardens, and the exceedingly beautiful, forget-me-not-like Eritrichium. That the vegetation here on the northernmost point of Asia has to contend with a severe climate is shown, among other things, as Dr. Kjellman has pointed out, by most of the flowering-plants there having a special tendency to form exceedingly compact half-globular tufts.

†

THE BEETLE LIVING FARTHEST TO THE NORTH.
Micralymma Dicksoni MÄKL.
Magnified twelve times.

The only insects which occurred here in any large number were poduræ, but some flies were also seen, and even a beetle, the before-mentioned Staphylinid. Of birds, there were seen a large number of sandpipers, an exceedingly numerous flock of barnacle geese—evidently migrating to more southerly regions, perhaps from some Polar land lying to the north of Cape Chelyuskin—a loom, some kittiwakes and ivory gulls, and remains of owls. Mammalia were represented by the bear already mentioned, and by the reindeer and the lemming, whose traces and dung were seen on the plains. In the sea, a walrus, several rough seals (*Phoca hispida*), and two shoals of white whales were seen.

All rivers were now dried up, but wide, shallow river-beds indicated that during the snow-melting season there was an abundant flow of water. The rush of snow rivulets and the cry of birds then certainly cause an interruption in the desolation

and silence which were now spread over the clay beds of the plains, nearly bare of all vegetation. Probably, however, a little farther into the country, in some valley protected from the winds of the Polar Sea, we might find quite different natural conditions, a more abundant animal life, and a vegetable world, in summer, as rich in flowers as that which we meet with in the valleys of Ice Fjord or the "Nameless Bay" (Besimannaja Bay). We saw no trace of man here. The accounts, which were current as early as the sixteenth century, relating to the nature of the north point of Asia, however, make it probable that the Siberian nomads at one time drove their reindeer herds up hither. It is even not impossible that Russian hunters from Chatanga may have prosecuted the chase here, and that Chelyuskin actually was here, of which we have evidence in the very correct way in which the Cape, that now rightly bears his name, is laid down on the Russian maps.[1]

The rocks consist of a clay-slate, with crystals resembling chiastolite and crystals of sulphide of iron interspersed. At the Cape itself the clay-slate is crossed by a thick vein of pure white

[1] This has been doubted by Russian geographers. Von Baer for instance says:—

"Darüber ist gar kein Zweifel, dass dieses Vorgebirge nie umsegelt ist, und dass es auf einem Irrthum beruhte, wenn Laptew auf einer Seefahrt die Bucht, in welche der Taimur sich mündet, erreicht zu haben glaubte. Seine eigenen späteren Fahrten erwiesen diesen Irrthum. Die Vergleichung der Berichte und Verhältnisse lässt mich aber auch glauben, dass selbst zu Lande man das Ende dieses Vorgebirges nie erreicht habe; sondern Tscheljuskin, um dieser, man kann wohl sagen, grässlichen Versuche endlich überhoben zu seyn, sich zu der ungegründeten Behauptung entschloss, er habe das Ende gesehen, und sich überzeugt, Sibirien sei nach Norden überall vom Meere umgränzt," [statement by von Baer in *Neueste Nachrichten über die nördlichste Gegend von Siberien;* von Baer and von Helmersen, *Beiträge zur Kenntniss des Russischen Reiches.* IV. St. Petersburg, 1841, p. 275]. In the following page in the same paper von Baer indeed says that he will not lay any special weight on Strahlenberg's statement that Siberia and Novaya Zemlya hang together, but he appears to believe that they are connected by a bridge of perpetual ice.

quartz. Here, according to an old custom of Polar travellers, a stately cairn was erected.

In order to get a good astronomical determination of the position of this important point I remained there until the 20th August at noon. The *Lena* was ordered to steam out to dredge during this time. Eight minutes north of the bay, where we lay at anchor, heavy and very close ice was met with. There the depth of the sea increased rapidly. Animal life at the sea-bottom was very abundant, among other things in large asterids and ophiurids.

OPHIURID FROM THE SEA NORTH OF CAPE CHELYUSKIN.
Oph'acantha bidentata, RETZ.
One and one-third of the natural size.

According to the plan of the voyage I now wished to steam from this point right eastwards towards the New Siberian Islands, in order to see if we should fall in with land on the way. On the 20th and 21st we went forward in this direction among scattered drift-ice, which was heavier and less broken up than that which we had met with on the other side of Taimur Land, but without meeting with any

serious obstacles. We fell in also with some very large ice-floes, but not with any icebergs. We were besides again attended by so close a mist that we could only see ice-fields and pieces of ice in the immediate neighbourhood of the vessel. Besides species of Lestris and kittiwakes we now also saw looms, birds that are almost wanting in the Kara Sea. Johannesen was of opinion that the presence of these birds showed that the sea is not completely frozen over in winter, because it is not probable that the loom in autumn and spring would fly across the frozen Kara Sea to seek in this distant region their food and their breeding-haunts.

The night before the 22nd we steamed through pretty close ice. The whole day so thick a fog still prevailed that we could not see the extent of the ice-fields in the neighbourhood of the vessel. Towards noon we were, therefore, compelled to take a more southerly course. When we found that we could not advance in this direction, we lay-to at a large ice-floe, waiting for clear weather, until in the afternoon the fog again lightened somewhat, so that we could continue our voyage. But it was not long before the fog again became so thick that, as the sailors say, you could cut it with a knife. There was now evidently a risk that the *Vega*, while thus continuing to "box the compass" in the ice-labyrinth, in which we had entangled ourselves, would meet with the same fate that befell the *Tegetthoff*. In order to avoid this, it became necessary to abandon our attempt to sail from Cape Chelyuskin straight to the New Siberian Islands, and to endeavour to reach as soon as possible the open water at the coast.

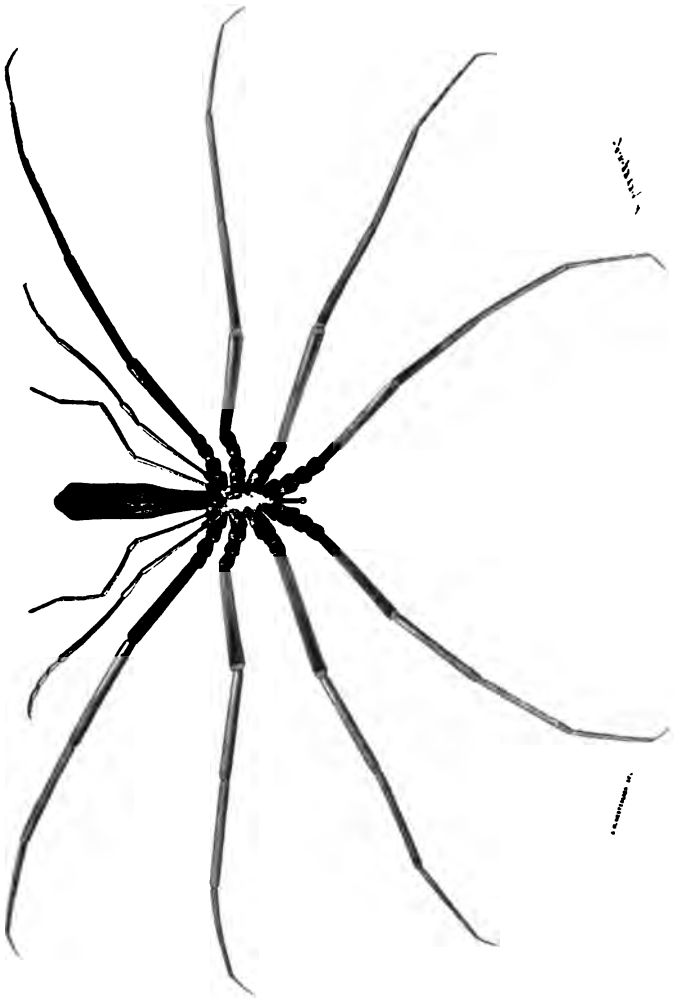
When it cleared on the morning of the 23rd, we therefore began again to steam forward among the fields of drift-ice, but now not with the intention of advancing in a given direction, but only of getting to open water. The ice-fields we now met with were very much broken up, which was an indication that we could not be very far from the edge of the *pack*. But

notwithstanding this, all our attempts to find penetrable ice in an easterly, westerly, or southerly direction were unsuccessful. We had thus to search in a northerly direction for the opening by which we had sailed in. This was so much the more unpleasant as the wind had changed to a pretty fresh N.W. breeze, on which account, with the *Vega's* weak steam-power, we could make way only slowly. It was not until 6.30 p.m. that we at last came to the sack-formed opening in the ice through which we had sailed in at noon of the previous day.

One can scarcely, without having experienced it, form any idea of the optical illusions, which are produced by mist, in regions where the size of the objects which are visible through the fog is not known beforehand, and thus does not give the spectator an idea of the distance. Our estimate of distance and size in such cases depend wholly on accident. The obscure contours of the fog-concealed objects themselves, besides, are often by the ignorance of the spectator converted into whimsical fantastic forms. During a boat journey in Hinloopen Strait I once intended to row among drift-ice to an island at a distance of some few kilometres. When the boat started the air was clear, but while we were employed, as best we could, in shooting sea-fowl for dinner, all was wrapt in a thick mist, and that so unexpectedly, that we had not time to take the bearings of the island. This led to a not altogether pleasant row by guess among the pieces of ice that were drifting about in rapid motion in the sound. All exerted themselves as much as possible to get sight of the island, whose beach would afford us a safe resting-place. While thus occupied, a dark border was seen through the mist at the horizon. It was taken for the island which we were bound for, and it was not at first considered remarkable that the dark border rose rapidly, for we thought that the mist was dispersing and in consequence of that more of the land was visible. Soon two white snow-fields, that we had not observed before, were seen on both sides of the land,

and immediately after this was changed to a sea-monster, resembling a walrus-head, as large as a mountain. This got life and motion, and finally sank all at once to the head of a common walrus, which lay on a piece of ice in the neighbourhood of the boat; the white tusks formed the snow-fields and the dark-brown round head the mountain. Scarce was this illusion gone when one of the men cried out "Land right a head—high land!" We now all saw before us a high Alpine region, with mountain peaks and glaciers, but this too sank a moment afterwards all at once to a common ice-border, blackened with earth. In the spring of 1873 Palander and I with nine men made a sledge journey round North-east Land. In the course of this journey a great many bears were seen and killed. When a bear was seen while we were dragging our sledges forward, the train commonly stood still, and, not to frighten the bear, all the men concealed themselves behind the sledges, with the exception of the marksman, who, squatting down in some convenient place, waited till his prey should come sufficiently within range to be killed with certainty. It happened once during foggy weather on the ice at Wahlenberg Bay that the bear that was expected and had been clearly seen by all of us, instead of approaching with his usual supple zigzag movements, and with his ordinary attempts to nose himself to a sure insight into the fitness of the foreigners for food, just as the marksman took aim, spread out gigantic wings and flew away in the form of a small ivory gull. Another time during the same sledge journey we heard from the tent in which we rested the cook, who was employed outside, cry out: "A bear! a great bear! No! a reindeer, a very little reindeer!" The same instant a well-directed shot was fired, and the bear-reindeer was found to be a very small fox, which thus paid with its life for the honour of having for some moments played the part of a big animal. From these accounts it may be seen how difficult navigation among drift-ice must be in unknown waters.

On the two occasions on which the vessel was anchored to ice-floes the trawl-net was used, and the hempen tangles. The



SEA SPIDER (PYCNOGONID) FROM THE SEA EAST OF CAPE CHELYUSKIN.
Half the natural size.

net was drawn forward slowly with the ice which was drifting to the north-west before a fresh S.E. breeze which was blowing

at the time. The yield of the trawling was extraordinarily abundant; large asterids, crinoids, sponges, holothuria, a gigantic sea-spider (Pycnogonid), masses of worms, crustacea, &c. *It was the most abundant yield that the trawl-net at any one time brought up during the whole of our voyage round the coast of Asia*, and this from the sea off the northern extremity of that continent.

Among the forms collected here we may specially refer to the large sea-spider, of which a drawing is given (p. 349); and three specimens of small stalked crinoids. The depth varied between 60 and 100 metres. The temperature of the water was at the surface + 0°·6 to — 0°·6; at the bottom —1°·4 to 1°·6; its salinity was considerable, both at the bottom, where it was very nearly equal to that of the other great oceans, and at the surface, where it was indeed about a fifth-part less, but yet much greater than that of the surface-water in the Kara Sea.

It is singular that a temperature under the freezing-point of pure water should be advantageous for the development of an animal life so extremely rich as that which is found here, and that this animal life should not suffer any harm from the complete darkness, which during the greater portion of the year prevails at the bottom of the ice-covered sea.

When we got out of the ice we steamed towards the land, which was sighted on the 23rd at 8.45 p.m. The land was low and free from snow; the depth of the sea at a distance of ten kilometres from the coast varied between thirteen and fifteen metres. The coast here stretched from north to south. We followed it at a distance of seven to ten kilometres. A north-westerly breeze here carried the vessel, without the help of steam, rapidly forward over a completely smooth sea.

On the 24th August we still sailed along the land towards the south. The depth of the sea now increased to thirty-three metres at a distance of ten kilometres from land. The land rose

gradually, and some distance from the coast beautiful mountain chains were seen, which, judging by the eye, rose to a height of from 600 to 900 metres. They were, like the plains along the coast, quite free from snow. Only in the clefts of the mountains there remained some few collections of snow or ice, which at two places appeared to form true glaciers, which however terminated at a considerable height above the sea. The snow-free slopes between the foot of the mountain and the shore bank, thirty to sixty metres high, formed an even plain, covered by a brownish-green turf, probably of the same nature as that we saw on Taimur Island.

During the forenoon we had splendid clear weather, and often we could see from the vessel no trace of ice. We saw a large number of walruses, and to judge by the fire which this sight kindled in the eyes of our hunters, it will not be long till the Norwegian hunting voyages are extended to the sea north and east of the north point of Asia. We saw besides a large number of looms and black guillemots, the former accompanied by young of the year, as large as rotges. About noon we sighted "land ahead to larboard." It was evidently Preobraschenie Island. I determined to land on it for a few hours to carry on researches in natural history, and to fix the position of the place by astronomical observations, if the weather should permit. The distance of this high-lying island was however greater than we expected. So that it was not until six o'clock in the evening that we could anchor off its south-west side, near the almost perpendicular face of cliffs abounding in sea-fowl.

During the last two days we had been sailing over a region, which on recent maps is marked as land. This shows that a considerable change must be made on the map of North Siberia, and I shall therefore quote here the observations on which the determination of our course is grounded.

	Observed Latitude.	Longitude
Cape Chelyuskin [1]	77° 36·8′	103° 17·2′
On board the *Vega* [2] at noon of the 21st Aug.	77° 25′	109° 12′
„ „ „ „ „ „ „ 22nd „	76° 53′	116° 9′
„ „ „ „ „ „ „ 23rd „	76° 48′	115° 0′
„ „ „ „ „ „ „ 24th „	75° 0′	113° 33′

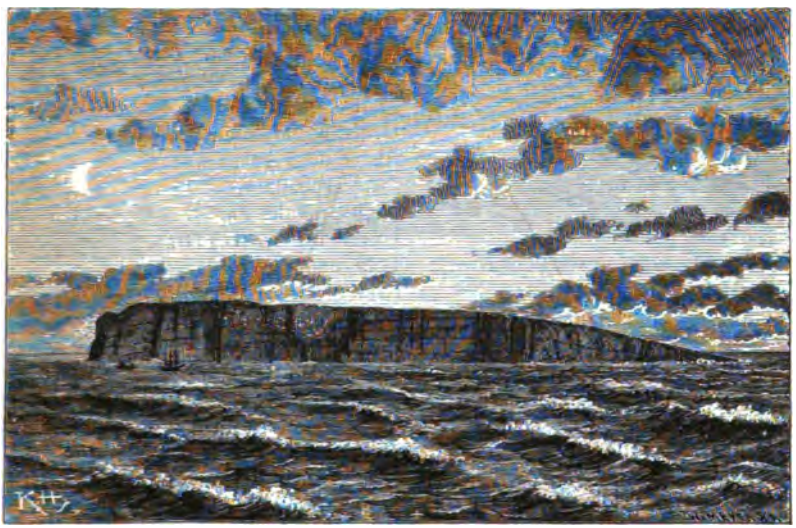
At the last mentioned point we had land to starboard of us at an estimated distance of 4′. Preobraschenie Island lay S. 21° W. 17·5′ off. It is on the ground of these data and of the courses recorded in the log, that the track of the *Vega* has been laid down on the map, and no doubt can arise that the position of the east coast of Taimur peninsula, as indicated by us, is in the main correct.

Preobraschenie Island forms a pretty even grassy plain, lying from thirty to sixty metres above the sea-level, which in the north-west terminates towards the sea with an almost perpendicular rocky wall, but to the south-east sinks gradually down to two sand-banks which run far out to sea. At the time of our visit the island was free of snow and covered with a carpet of mosses mixed with grass, which was exceedingly abundant, especially on the south-west slopes of the island, protected as they were from the north winds. Here we encountered anew the Arctic animal world in all its profusion. The ledges of the perpendicular shore-cliffs of the island formed the breeding-place of numberless looms and kittiwakes, to which a few black guillemots attached themselves. Along the farthest margin of the beach waders ran busily backwards and forwards in order to collect their food. At the summits of the cliffs a flock of glaucous gulls were breeding, and on the slopes of the low land the white mountain owl was seen lying in wait

[1] According to an observation with an artificial horizon on land.

[2] According to an observation on board. The observations for longitude that were made some hours before or after noon, are reduced to noon.

for its prey, quiet and motionless for hours, but as usual it was wary and shy, so that it was only with difficulty that the hunter could get within range of it. At some places there extended between the foot of the "loomery" and the sea a stone-bestrewn beach, which at high water was mostly covered by the sea, and at low water was full of shallow salt-water pools. Here had settled two Polar bears that were soon killed, one by Lieutenant



PREOBRASCHENIE ISLAND.
(After a sketch by O. Nordquist.)

Brusewitz, the other by Captain Johannesen. The bears had evidently been on the hunt for looms, which along with their young, large as rotges and already able to swim, were swimming in the pools of water at the foot of the "loomery," and above all perhaps they were lying in wait for birds which by some accident happened to fall down from the breeding-place. In the sea no small number of seals were seen, and but a few hours before our arrival at the island we had sailed past herds of walrus.

Vegetation was much more luxuriant and richer in species than at Cape Chelyuskin, and naturally bore a more southern stamp, not only in consequence of the more southerly position of the island, but also on account of its shores being washed by the water of the Chatanga river, which is warm during summer.[1]

Unfortunately, on account of the advanced season of the year

[1] The following 65 species were collected here by Dr. Kjellman.—

Saussurea alpina DC.
Gymnandra Stelleri CHAM. & SCHLECHT.
Pedicularis hirsuta L.
Eritrichium villosum BUNGE.
Myosotis silvatica HOFFM.
Phaca frigida L.
Dryas octopetala L.
Sieversia glacialis R. BR.
Potentilla emarginata PURSH.
Saxifraga oppositifolia L.
„ bronchialis L.
„ flagellaris WILLD.
„ Hirculus L.
„ serpyllifolia PURSH.
„ stellaris L. f. comosa.
„ nivalis L.
„ hieraciifolia WALDST. & KIT.
„ punctata L.
„ cernua L.
„ rivularis L.
„ cæspitosa L.
Chrysosplenium alternifolium L.
Eutrema Edwardsii R. BR.
Parrya macrocarpa R. BR.
Cardamine bellidifolia L.
Cochlearia fenestrata R. BR.
Draba alpina L.
Papaver nudicaule L.
Ranunculus pygmæus WG.
„ hyperboreus ROTTB.
„ nivalis L.
„ sulphureus SOL.
Caltha palustris L.
Wahlbergella apetala (L.) FR.
Stellaria humifusa ROTTB.
„ Edwardsii R. BR.
Cerastium alpinum L.
Alsine macrocarpa FENZL.
„ rubella WG.
Sagina nivalis FR.
Oxyria digyna (L.) HILL.
Polygonum viviparum L.
Salix arctica PALL.
„ reticulata L.
„ polaris WG.
Poa arctica R. BR.
„ pratensis L.
Glyceria angustata R. BR.
„ vilfoidea (ANDS.) TH. FR.
Arctophila pendulina (LÆST.) AND.
Catabrosa algida (SOL.) FR.
Colpodium latifolium R. BR.
Dupontia Fisheri R. BR.
Aira cæspitosa L.
Hierochloa pauciflora R. BR.
Alopecurus alpinus SM.
Eriophorum angustifolium ROTH.
„ russeolum FR.
„ Scheuchzeri HOPPE.
Carex ursina DESV.
„ aquatilis WG.
Juncus biglumis L.
Luzula hyperborea R. BR.
„ arctica BL.
Lloydia serotina (L.) REICHENB.

I could only allow the *Vega* to remain a few hours off this interesting island, and at 10.30 p.m. accordingly the anchor was weighed and our voyage along the coast resumed.

On the 25th, 26th and 27th August we had for the most part calm, fine weather, and the sea was completely free of ice. The temperature of the water again rose to +5°·8, and its salinity diminished considerably. But the depth now decreased so much, that, for instance, on the night before the 26th we had great difficulty in getting past some shoals lying west of the delta of the Lena, off the mouth of the Olonek.

It had originally been my intention to let the *Vega* separate from the *Lena* at some anchorage in one of the mouth-arms of the Lena river. But on account of the shallowness of the water, the favourable wind and the ice-free sea, that now lay before us to the eastward, I determined to part from the *Lena* in the open sea off Tumat Island. This parting took place on the night between the 27th and 28th August, after Captain Johannesen had been signalled to come on board the *Vega*, to receive orders, passport,[1] and letters for home. As a parting salute to our trusty little attendant during our voyage round the north point of Asia some rockets were fired, on which we steamed or sailed on, each to his destination.

During our passage from Norway to the Lena we had been much troubled with fog, but it was only when we left the navigable water along the coast to the east of Cape Chelyuskin that we fell in with ice in such quantity that it was an obstacle to our voyage. If the coast had been followed the whole time, if the weather had been clear and the navigable water sufficiently surveyed, so that it had been possible to keep the course of the vessel near the land, the voyage of the *Vega* to the mouth

[1] Before our departure, I had through the Swedish Foreign Office obtained from the Russian Government letters patent in which the Russian authorities with whom we might come in contact were instructed to give us all the assistance that circumstances might call for.

of the Lena *would never have been obstructed by ice*, and I am convinced that this will happen year after year during the close of August, at least between the Yenisej and the Lena. For I believe that the place where ice-obstacles will perhaps be met with most frequently will not be the north point of Asia, but the region east of the entrance to the Kara Sea.

CHAPTER VIII.

The voyage of the *Fraser* and the *Express* up the Yenisej and their return to Norway—Contract for the piloting of the *Lena* up the Lena river—The voyage of the *Lena* through the delta and up the river to Yakutsk—The natural state of Siberia in general—The river territories—The fitness of the land for cultivation and the necessity for improved communications—The great rivers, the future commercial highways of Siberia—Voyage up the Yenisej in 1875—Sibiriakoff's Island—The *tundra*—The primeval Siberian forest—The inhabitants of Western Siberia: the Russians, the Exiles, the "Asiatics"—Ways of travelling on the Yenisej: dog-boats, floating trading stores propelled by steam—New prospects for Siberia.

I HAVE mentioned in the Introduction that the *Vega* during the first part of the voyage was accompanied by three other vessels, which together with the principal vessel of the Expedition stood at my disposal and under my orders, and I have stated in passing that their voyages too deserve a place in the history of navigation. Now, when we were parted from the vessel which had accompanied the *Vega* farthest in her route eastwards, it may be the proper place to give a brief account of the close of the voyages of the *Fraser*, the *Express*, and the *Lena*, and give reasons for what I have said of the importance of these voyages.

On the 9th August at 10 a.m., after Mr. Serebrenikoff had gone on board the *Express* to take command, as Sibiriakoff's commissioner, of the two vessels bound for the Yenisej, the *Fraser*, with the *Express* in tow, started from Port Dickson for the river. The voyage passed without other adventures than

that in consequence of unacquaintance with the navigable waters the vessel sometimes gently grounded. On the 11th August Korepovskoj was reached, the same place where I laid up in 1876 the goods which I had brought with me in the *Ymer*. Here my old friend from my voyages of 1875 and 1876, the Cossack Feodor, was taken on board. He however proved now as unskilful a pilot as before. Notwithstanding his experience in 1876, when he several times ran the *Ymer* aground, he had

THE STEAMER "FRASER."

not yet got a clear idea of the difference between the build of an ocean vessel and of the common flat-bottomed Yenisej lighters, and his conception of the responsibility of a pilot was expressed by his seeking, when he was allowed to take his own course, to forget in the arms of sleep all dangers and difficulties. Mr. Serebrenikoff and the captains of the vessels were therefore themselves compelled by means of frequent soundings,

which were commonly made from a steam launch in advance, to endeavour to find out the proper course. The navigable water between the level islands covered with bushy thickets and rich grassy meadows was often very narrow, but appears to have been pretty deep, as, even when the vessels went forward without the guidance of a skilful pilot, there was a depth of from 5 to 30 metres; and after a fisher, who knew the river better than Feodor, had been taken on board, it was found possible to go at full speed between the more southerly of the Briochov Islands[1] in a depth of 30 to 50 metres. On 14th August the vessels reached Tolstojnos, where a very well preserved *simovie* is situated about 70° 10′ N.L., 370 kilometres south of Port Dickson. On the 15th August they anchored in a good haven at Saostrovskoj, a *simovie* lying 100 kilometres farther up the river at the limit of trees, where the goods were to be discharged and another cargo taken on board. After a jetty had been constructed on the 16th, the landing of the goods began on the 17th, and was finished on the 20th. The *Fraser* went still farther up the river to Dudino, in order to load various goods laid up there—tallow, wheat, rye, and oats. On the 2nd September the steamer returned to Saostrovskoj, where in the meantime the *Express* had taken on board her cargo.

Dudino is a church village, situated at the point where the river Dudinka flows into the Yenisej. Here live two priests, a *smotritel* (a police official), a couple of exiles, some Russian workmen, and a number of natives, as well as the owner of the place, the influential merchant SOTNIKOFF. This active and able man is in an economical point of view ruler over the whole of the surrounding region, all whose inhabitants are in one way or other dependent upon him. He exchanges grain, brandy, sugar, tea, iron goods, powder and lead, cloth and leather, for furs, fish, mammoth-ivory, &c.; and these goods are sent by

[1] With this name, for want of another, I denote all the innumerable islands which lie in the Yenisej between 69° 45′ and 71° N.L.

steamer to Yenisejsk to be forwarded from thence to China, Moscow, St. Petersburg, &c. Among other things he is also the owner of very thick coal-seams in the Noril Mountains lying about 60 kilometres from Dudino. This simple and unostentatious man has been very obliging to all the scientific men who have visited the region. His dwelling, situated in the neighbourhood of the limit of trees, is probably the stateliest palace of the Siberian *tundra*, admired by natives from far and near. It is built of large logs, consists of two stories, has a roof painted green, many windows with decorated frames painted white and blue; the rooms are warm, provided with carpets of furs, pot-flowers in the windows, numerous sacred pictures, photographs, and copper engravings.

On the 7th September all was ready for departure. The *Fraser* and *Express* weighed anchor to commence the return voyage down the river. At Tolstojnos two days after they met the steamer *Moskwa*[1] of Bremen, Captain Dallmann, having on board the crew of the Norwegian steamer *Zaritza*, Captain Brun, which had stranded at the mouth of the Yenisej and been

[1] The *Moskwa* was the first steamer which penetrated from the Atlantic to the town of Yenisejsk. The principal dates of this voyage may therefore be quoted here.

Baron Knoop, along with several Russian merchants, had chartered in 1878 a steamer, the *Louise*; but this vessel stranded on the coast of Norway. The *Zaritza*, another Norwegian steamer, was chartered instead to carry the *Louise's* goods to their destination. But this vessel too stranded at the mouth of the Yenisej, and was abandoned by the crew, who were rescued by a small steamer, the *Moskwa*, which accompanied the *Zaritza*. In this steamer Captain Dallmann, the Bremen merchant Helwig Schmidt, and Ehlertz, an official in the Russian finance office, now travelled up the river. The *Moskwa* had a successful voyage, arriving on the 4th September at Goltschicha, passing Turuchansk in consequence of a number of delays only on the 24th September, reaching Podkamenaja Tunguska on the 1st October, and on the 14th of the same month its destination, a winter harbour on the Tschorna river, some miles north of Yenisejsk. (Fahrt auf dem Yenissej von der Mündung bis Yenisejsk im Sommer 1878; Petermann's *Mittheilungen*, 1879, p 81.)

abandoned by the crew. In the case of this stranding, however, the damage done had not been greater than that, when the *Fraser* fell in with the stranded *Zaritza*, it could be pumped dry, taken off the shoal, and, the engine having first been put in order, carried back to Norway. On the 19th September all the three vessels arrived at Matotschkin Sound, where they lay some days in Beluga Bay in order to take in water and trim the cargo and coal; after which on the 22nd of the same month they sailed through the sound to the west, and on the 26th anchored at Hammerfest in good condition and with full cargoes.[1] The goods, which now for the first time were carried from the Yenisej to Europe, consisted of about 600 tons—tallow, wheat, rye and oats. The goods imported into Siberia consisted mainly of 16 tons nails, 8 tons horseshoes, 4 tons horsenails, 16½ tons bar iron, 33 tons tobacco, 60 tons salt, 24 casks petroleum, an iron lighter in pieces with the necessary adjuncts of anchors, &c.[2]

Before I begin to give an account of the voyage of the *Lena* I must briefly mention the steps which Mr. Sibiriakoff took for her safety during her voyage from the mouth of the river, where she was to part from the *Vega*, to her proper destination, the town of Yakutsk. It is naturally very difficult for a vessel to seek her way without a pilot through an extensive delta completely unknown in a hydrographic respect, and crossed by a large number of deeper or shallower river arms. Mr. Sibiriakoff had therefore arranged that a river pilot should meet the *Lena* at the north point of the delta, and had through Mr. Kolesoff negotiated with him the following contract, which I reproduce here in

[1] The particulars of the voyages of these vessels are taken from a copy which I have received of Captain Emil Nilsson's log.

[2] The goods carried by me and by Wiggins to the Yenisej in 1876, and those which Schwanenberg carried thence in 1877, were properly only samples on a somewhat large scale. I have no knowledge of the goods which the *Zaritza* had on board when she ran aground at the mouth of the Yenisej.

full, because it gives in several respects a very graphic picture of various social relations in these remote regions. The copy of the contract which has been communicated to me when translated runs thus:—

At Yakutsk, in the year one thousand eight hundred and seventy-eight on the 18th February, I, the undersigned Yakut AFONASII FEODOROFF WINOKUROFF, have concluded the following contract with IVAN PLATONOWITSCH KOLESOFF, merchant of the second guild in the town of Yakutsk.

1. I, Winokuroff bind myself as pilot to carry the vessel of Professor Nordenskiöld's expedition up the river Lena from the village Tas-Ary, which lies about 150 versts below the village Bulun. From Tumat Island, which is situated in the north-eastern part of the Lena delta, I bind myself for the piloting of the same vessel to procure at my own cost among the inhabitants of the place a pilot who knows well the deepest channel of the Lena river as far as the village Tas-Ary. This pilot the chief of the expedition shall discharge at the village Tas-Ary.

2. As I am not master of the Russian language I bind myself to bring along with me a Yakut interpreter, who knows the Russian language and is able to write. In May of this year, I, Winokuroff, with the interpreter shall travel from the town of Yakutsk down the Lena river to Tumat Island and there along with the interpreter wait for the expedition.

3. During the passage down the river I am bound to hire among the inhabitants of the regions a competent guide, who shall accompany us in my own boats to the island by the deepest channel in the Lena delta. During the passage from the village Tas-Ary I shall take soundings and record the depth of the fairway.

4. Between the village Bulun and Tumat Island, I bind myself to seek for two places for the wintering of the vessel, which are quite suitable for the purpose, and protected from ice. I shall further lay before the commander of the expedition a journal containing everything which I can find that it would be advantageous to know for the safety of navigation and for the wintering of the vessels, also accounts of the places which are dangerous or unsuitable for navigation.

5. On my arrival at Tumat Island I shall make it my first duty to find a deep and convenient haven for the seagoing vessels on the western side of the island. For this purpose I bind myself to have with me two boats, which, if necessary, shall be given

over to the expedition. At the haven when found I bind myself to erect on some eminence near the shore of the island, which can be seen from Cape Olonek, a signal tower of driftwood or earth, like a Cossack mound, not lower than seven feet. On this foundation I shall raise a pyramidal frame of three or more thick logs, on the top of which I shall fix a flagstaff with a pulley block for the flag. The flag is to be flown at least 42 feet from the ground. I shall guard the landmark thus erected until the river freezes. For this purpose Herr Kolesoff has provided me with a ready-made flag, a pulley block and a line. And when the nights become dark I shall light two or three large fires or hang up lanterns on the landmark itself, so that these fires or lanterns may be seen from the sea.

6. From the village Tas-Ary I shall carry the vessel of the expedition to the town of Yakutsk, inasmuch as I shall show the proper fairway on the Lena river. The interpreter shall be at my side during the whole journey.

7. During the whole time from the day when I start from Yakutsk, up to the close of my time of service in Nordenskiöld's expedition we, I, Winokuroff, and my interpreter, must be always sober (never intoxicated), behave faithfully and courteously, and punctually comply with the captain's orders.

8. For all these obligations Herr Kolesoff has to pay me 900 roubles.

9. After the arrival of the expedition at Yakutsk I will not be allowed to leave the ship without the permission of the chief, but shall still remain on board. If the captain finds it necessary that I accompany him back to the mouth of the Lena, I shall conform to his wish in consideration of an extra fee of 300 roubles. During this latter passage I am not bound to have with me any interpreter.

10. If the arrival of the expedition at Tumat Island is delayed by any circumstance to the month of November, I have the right to betake myself along with my interpreter to Yakutsk and here to produce to Herr Kolesoff an official certificate given by Commandant Baschleff or any other local official that I had erected a landmark on Tumat Island and remained there until the river was frozen over, and that I did not leave until the expedition was no longer to be expected. Then Herr Kolesoff on the ground of this contract must settle with me by paying me the whole sum of 900 roubles, together with 200 roubles for my return journey.

11. If the vessel of the expedition arrive at Tumat Island so late that the voyage becomes impossible, we, I and my interpreter,

shall winter with the expedition until the river becomes open in 1879. And in this case we, I and my interpreter, shall live at our own expense, and serve the expedition as belonging to its crew. After the commencement of navigation in 1879 I shall conduct the vessel from the wintering station to the town of Yakutsk. On this account I have to receive, besides the 900 roubles coming to me, 800 roubles more. If during this voyage too it should be necessary to accompany the vessels from Yakutsk back to the mouth of the Lena, I shall do that, and receive on that account 300 roubles. But if the vessels winter at Yakutsk, I shall be free during winter, and only during next year's voyage, if so required, accompany them to the mouth of the Lena. In that case I have to receive 300 roubles.

12. Of this sum agreed upon Herr Kolesoff shall pay me in advance on the conclusion of this contract 300 roubles, in the month of May at my departure 150 roubles, and at the village Bulun 250 roubles, for my payment to my companions and pilot and other expenses. The balance shall be paid to me after my return to Yakutsk.

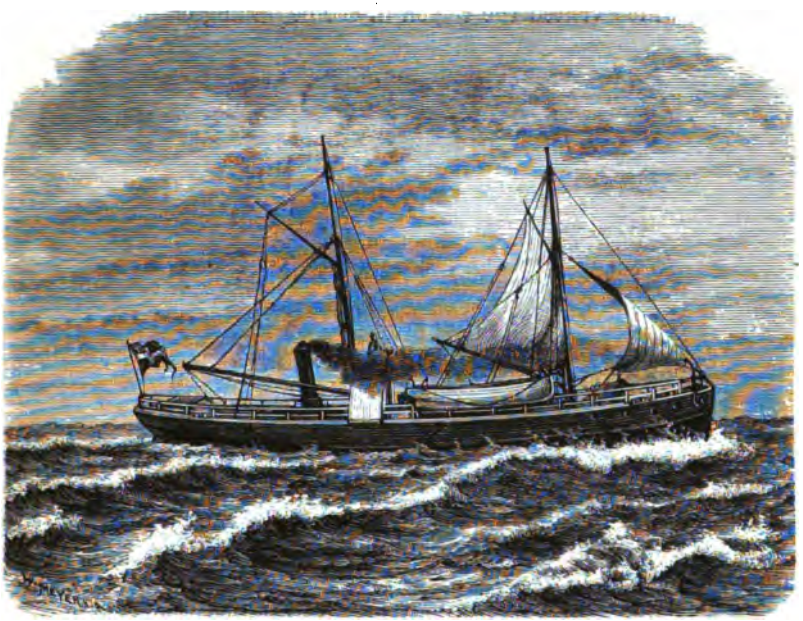
13. In the month of May, at the time for starting, if I be prevented by illness from betaking myself to Tumat Island, I shall repay to Herr Kolesoff the sum paid to me at the conclusion of this contract, with the exception of the money I have paid to the interpreter as pocket-money and for the boats. Should I not be able to repay the sum, I, Winokuroff, shall work out the amount not repaid at Herr Sibiriakoff's gold mines.

14. All this are we, the two contracting parties, bound to observe in full and without infringement.

A note to the copy further informs us that to this contract the Yakut Afonasii Feodoroff Winokuroff had, in place of his signature, attached his own seal, which the Yakut Alexii Zassimoff Mironoff had engraved, and that the conditions had been approved by the merchant Ivan Kolesoff, and the whole registered at the police-office of the Yakutsk circle.

The contract had been entered into with the friendly co-operation of the Governor and Bishop of Yakutsk, who were much interested in the proposed voyage. The latter knew the coast of the Polar Sea from his own experience. But notwithstanding all this, the affair was attended with no better success than that

the pilot celebrated the receipt of the large sum of money by getting thoroughly intoxicated, and while in that state he broke one of the bones of the fore-arm. He was thus unable ever to reach the appointed rendezvous, and Johannesen was allowed to manage by his own hand, as best he could, his little steamer.



THE STEAMER "LENA."

After the *Lena* had parted with the *Vega* during the night between the 27th and 28th August, she steamed towards land, and came the same day to the northernmost cape of the Lena delta, situated in 73° 47′ N.L.[1] It was here that the pilot's landmark was to have been erected, but there was no pilot here,

[1] According to Johannesen's determination. On Wrangel's map the latitude of this cape is given as 73° 30′. Johannesen found the longitude to be 125° 31′ instead of 127°.

and no flagstaff was visible. In order to fall in with this landmark Johannesen sailed forty kilometres westward along the shore, but as his search in this direction was not attended with success, he turned back to the first-mentioned place and landed there. On the shore stood a very old hut, already completely filled with earth. It probably dated from some of the expeditions which visited the region in the beginning of the century.

HANS CHRISTIAN JOHANNESEN.
Captain of the "Lena." Born in 1846.

Wild reindeer were seen in large numbers. As according to the contract which has been quoted the landmark was to be visible from Cape Olonek, Johannesen steamed once more to the west, running as close to the land as possible. But as the water here became shallower and shallower without any signal-tower being visible, Johannesen had to find his way himself through the delta; and for this purpose he determined to search for the easternmost arm of the river, which, on the maps, is drawn

as being very broad, and also appears to have been made use of by the vessels of "the great northern expeditions."[1]

Forty kilometres east of the northern extremity of the Lena delta Johannesen encountered three sandbanks, which he sailed round. After passing these the water became deeper, so that he could advance at a distance of five kilometres from land. On the 1st September Johannesen anchored in a bay on the mainland in the neighbourhood of the Bychov mouth, whence on the 3rd September, at 2.30 a.m., he continued his course up the river, but by 10 o'clock the *Lena* was aground. The water was falling, and did not begin to rise until an hour after midnight. It was not, therefore, until 8 a.m. the following day that the *Lena* was got off, and that with great difficulty. The sailing through the delta was rendered difficult by the maps, which were made 140 years ago, being now useless. For the delta has undergone great alterations since then. Where at that time there were sandbanks, there are now large islands, overgrown with wood and grass. At other places again whole islands have been washed away by the river.

While the vessel was aground nine Tunguses came on board They rowed in small boats, which were made of a single tree stem, hollowed out, and could just carry a man each. Johannesen endeavoured in vain to induce some of the Tunguses to pilot the steamer; he did not succeed in explaining his wish to them, notwithstanding all the attempts of the Russian interpreter, a proof of the slight contact these Tunguses had had

[1] According to Latkin (Petermann's *Mittheilungen*, 1879, p. 92), the Lena delta is crossed by seven main arms, the westernmost of which is called Anatartisch. It debouches into the sea at a cape 58 feet high named Ice Cape (Ledjanoi). Next come the river arm Bjelkoj, then Tumat, at whose mouth a landmark erected by Laptev in 1739 is still in existence. Then come the other three main arms, Kychistach, Trofimov, and Kischlach, and finally the very broad eastmost arm, Bychov. Probably some of the smaller river arms are to be preferred for sailing up the river to this broad arm, which is fouled by shoals.

with the rulers of Siberia, and also of the difficulty and unwillingness with which the savage learns the language of the civilised nations.

It was not until the 7th September that the delta was finally passed, and the *Lena* steamed in the river proper, where the fairway became considerably better. Johannesen says in his account of the voyage that it is improbable that any of the western arms of the Lena are of importance, partly because the mass of water which flows in an easterly direction is very considerable in comparison with the whole quantity of water in the river, partly because the western and northern arms which Johannesen visited contained only salt water, while the water in the eastern arm was completely free from any salt taste. On the 8th, early in the morning, the first fixed dwelling-place on the Lena, Tas-Ary, was reached. Here the voyagers landed to get information about the fairway, but could not enter into communication with the natives, because they were Tunguses. In the afternoon of the same day they came to another river village, Bulun. Impatient to proceed, and supposing that it too was inhabited wholly by "Asiatics,"[1] Johannesen intended to pass it without stopping. But when the inhabitants saw the steamer they welcomed it with a salute from all the guns that could be got hold of in haste.[2] The *Lena* then anchored. Two Crown officials and a priest came on board, and the latter performed a thanksgiving service.

Even at that remote spot on the border of the *tundra* the Asiatic comprehended very well the importance of vessels from the great oceans being able to reach the large rivers of Siberia. I too had a proof of this in the year 1875. While still rowing up the river in my own Nordland boat with two scientific men and three hunters, before we got up with the steamer *Alexander* we landed, among others, at a place where a number of Dolgans

[1] A common name used in Siberia for all the native races.

[2] This has been incorrectly interpreted as if they shot at the vessel.

In order to give an idea of the influence which this sea-route may have on the commerce of the world, and the new source of fortune and prosperity which thereby may be rendered accessible to millions, I shall in a few words give an account of the nature of the territory which by means of this sea-communication will be brought into contact with the old civilised countries of Europe.

YAKUTSK IN OUR DAYS.
(After a recent Russian drawing.)

If we take Siberia in its widest sense, that is to say, if we include under that name not only Siberia proper, but also the parts of High Asia which lie round the sources of the great Siberian rivers, this land may very well be compared in extent, climate, fertility, and the possibility of supporting a dense population, with America north of 40° N.L. Like America, Siberia is occupied in the north by woodless plains. South of this region, where only the hunter, the fisher, and the reindeer

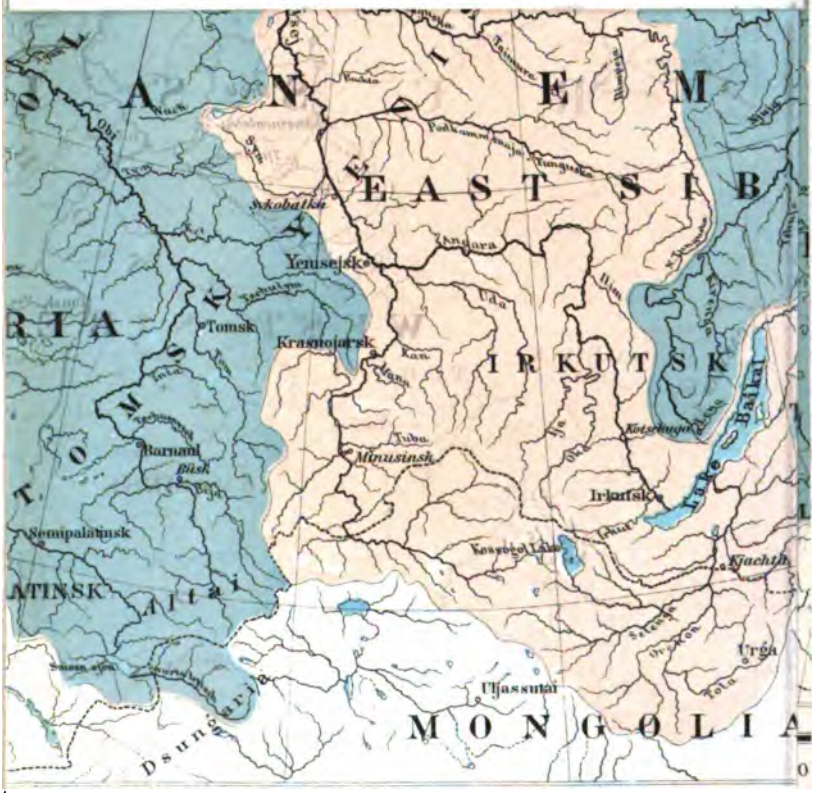
nomad can find a scanty livelihood, there lies a widely extended forest territory, difficult of cultivation, and in its natural conditions, perhaps, somewhat resembling Sweden and Finland north of 60° or 61° N.L. South of this wooded belt, again, we have both in Siberia and America, immeasurable stretches of a exceedingly fertile soil, of whose power to repay the toil of the cultivator the grain exports during recent years from the frontier lands between the United States and Canada have afforded so striking evidence. There is, however, this dissimilarity between Siberia and America, that while the products of the soil in America may be carried easily and cheaply to the harbours of the Atlantic and the Pacific, the best part of Siberia, that which lies round the upper part of the courses of the Irtisch-Ob and the Yenisej, is shut out from the great oceans of the world by immense tracts lying in front of it, and the great rivers which in Siberia cross the country and appear to be intended by nature to form not only the arteries for the inner life, but also channels of communication with the rest of the world, all flow towards the north and fall into a sea which down to the most recent times, has been considered completely inaccessible.

Of these rivers the double river, Ob-Irtisch, with its numerous affluents, occupies an area of more than 60,000 geographical square miles, the Yenisej-Angara, not quite 50,000, and the Lena, somewhat over 40,000.[1] As the map of the river system

[1] In order not to write without due examination about figures which have been written about a thousand times before, I have, with the help of Petermann's map of North and Middle Asia in Stieler's Hand-Atlas, calculated the extent of the areas of the Siberian rivers, and found them to be :—

	Square kilometres.	Geographical square miles.
River area of the Ob (with the Tas) ...	3,445,000	62,560
" " " Yenisej	2,712,000	49,250
" " " Lena...	2,395,000	43,500

Of these areas 4,966,000 square kilometres, or about 90,000 geographical square miles, lie south of 60° N.L.



EAST SIB
IRKUTSK
Yenisejsk
Tomsk
Krasnojarsk
Minusinsk
Irkutsk
Kjachta
Urga
Uljassutai
Semipalatinsk
Barnaul
Altai
Dsungaria
MONGOLIA
Lake Baikal
Kossogol Lake
Sykobatka
Angara
Uda
Ilim
Kan
Tuba
Tom
Tula
Obi
Tym
Nask
Syn
Podkamennaja
Tunguska
Kotschuga
Selenga
Orchon
Tola
Irkut
Oka
Ija
Bija
Bush

Valjamok

of Siberia, which accompanies this work, shows, but a small part of these enormous territories lies north of the Arctic Circle, and only very inconsiderable portions of it are occupied by woodless *tundra*, which is explained by the fact that the greater part of the coast-land bordering on the Arctic Ocean is drained by small rivers of its own, and therefore cannot be considered to belong to the river territories now in question. If we draw the northern boundary of the land that may be cultivated with advantage at 60° N.L., there remains a cultivable area of 90,000 geographical square miles. Perhaps a third part of this is occupied by rocky country which is wooded, and probably capable of being cultivated only with considerable difficulty, but the rest consists for the most part of easily cultivated grassy plains, with little wood, and covered with the most luxuriant vegetation. The soil, in many places resembling the black earth or *tscherno-sem* of Russia, recompenses with abundant harvests even the slightest labour of cultivation. Notwithstanding this, these regions now support only an exceedingly sparse population, but many, many millions may without difficulty find their subsistence there when once cultivation has developed the rich natural resources of the country.

It is a circumstance specially fortunate for the future development of Siberia that its three great rivers are already navigable for the greater part of their course. The Ob is navigable from Biisk (52½° N.L.), and the Irtisch at least from Semipalitinsk (50° 18′ N.L.). The Yenesej, again, which, after leaving the region of its sources in China, crosses with its two main arms the whole of Siberia from north to south, from the forty-sixth to the seventy-third degree of latitude, and thus traverses a territory which corresponds in length to the distance between Venice and the North Cape, or between the mouth of the Mississippi and the north part of Lake Winnipeg, and is already navigable by nature from the sea to Yenisejsk. To this town goods are already transported *down* both the main arms from Minusinsk

and the region of Lake Baikal. It is said that the Angara might be made quite navigable during its whole course at an expenditure trifling in comparison with the advantages that would thus be gained, as well as its continuation, the Selenga, in its lower part between the Chinese frontier and Lake Baikal. In this way a river route would be opened for the conveyance of the products of North China and South Siberia to a sea which an ordinary steamer would cross in five or six days to the White Sea or the North Cape. A similar communication with the Atlantic may be opened on the double river Ob-Irtisch with Western Siberia and High Asia as far as to Chinese Dsungaria, where the Irtisch begins its course as a small river, the Black Irtisch, which falls into Lake Saisan, and rises south of the Altai Mountains in the neighbourhood of the Selenga, the source-river of the Yenisej. At several places the river territories of the Ob and the Yenesej nearly reach hands to one another through affluents, which rise so close to each other that the two river systems might easily be connected by canals. This is also the case with the affluents of the Yenesej and the Lena, which at many places almost meet, and the Lena itself is, according to Latkin's statement, navigable from the village of Kotschuga to the sea. We see from this how extraordinarily advantageous is the natural system of interior communication which Siberia possesses, and at the same time that a communication by sea between this country and the rest of the world is possible only by the Arctic Ocean. It is on this that the enormous importance of the navigation of the Siberian Polar Sea depends. If this can be brought about, Siberia, with an inconsiderable expenditure in making canals, will not only become one of the most fortunate countries of the globe in respect of the possibility of the cheap transport of goods, but the old proposal of a north-eastern commercial route to China may even become a reality. If, on the other hand, navigation on the Polar Sea be not brought about, Siberia will still long remain what it is

at present—a land rich in raw materials, but poor in all that is required for the convenience and comfort with which the civilised man in our days can with difficulty dispense.

Many perhaps believe that the present want of commercial communication may be removed by a railway running across Russia and Southern Siberia. But this is by no means the case. On the contrary, communication by sea is an indispensable condition of such a railway being profitable. For it can never come in question to carry on a railway the products of the forest or the field over the stretch of three to five thousand kilometres which separates the fertile river territory of the Ob-Irtisch from the nearest European port. Even if we suppose that the railway freight, inclusive of all costs, could be reduced to a farthing the kilometre-ton, it would in any case rise, from the grain regions of Siberia to a harbour on the Baltic, to from 4*l.* to nearly 7*l.* per ton. So high a freight, with the costs of loading in addition, none of the common products of agriculture or forestry can stand, as may easily be seen if we compare this amount with the prices current in the markets of the world for wheat, rye, oats, barley, timber, &c. But if the Siberian countryman cannot sell his raw products, the land will continue to be as thinly peopled as it is at present, nor can the sparse population which will be found there procure themselves means to purchase such products of the industry of the present day as are able to bear long railway carriage. In the absence of contemporaneous sea-communication the railway will therefore be without traffic, the land such as it is at present, and the unprosperous condition of the European population undiminished.

In order to give the reader an idea of the present natural conditions, and the present communication on a Siberian river, I shall, before returning to the sketch of the voyage of the *Vega*, give some extracts from notes made during my journey up the Yenesej in 1875, reminding the reader, however, that

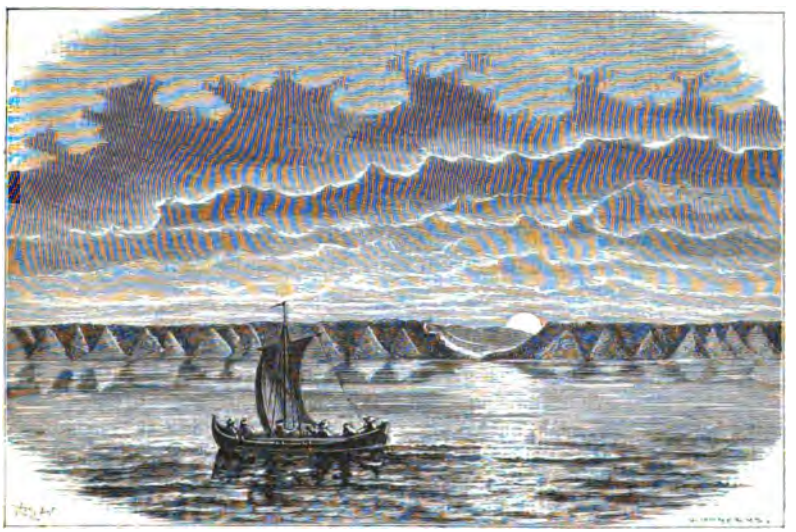
the natural conditions of the Ob-Irtisch and the Lena differ considerably from those of the Yenisej, the Ob-Irtisch flowing through lower, more fertile, and more thickly peopled regions, the Lena again through a wilder, more beautiful, but less cultivated country.

When one travels up the river from Port Dickson, the broad sound between Sibiriakoff's Island and the mainland is first passed, but the island is so low that it is not visible from the eastern bank of the river arm which is usually followed in sailing up or down the river. The mainland, on the other hand, is at first high-lying, and in sailing along the coast it is possible to distinguish various spurs of the range of hills, estimated to be from 150 to 200 metres high, in the interior. These are free of snow in summer. A little south of Port Dickson they run to the river bank, where they form a low rock and rocky island projecting into the river, named after some otherwise unknown Siberian Polar trapper, Yefremov Kamen.

Sibiriakoff's Island has never, so far as we know, been visited by man, not even during the time when numerous *simovies* were found at the mouth of the Yenesej. For no indication of this island is found in the older maps of Siberia, although these, as appears from the fac-simile reproduced at page 192, give the names of a number of *simovies* at the mouth of the Yenisej, now abandoned. Nor is it mentioned in the accounts of the voyages of the great northern expeditions. The western strand of the island, the only one I have seen, completely bore the stamp of the *tundra* described below. Several reindeer were seen pasturing on the low grassy eminences of the island, giving promise of abundant sport to the hunter who first lands there.

Still at Yefremov Kamen we saw in 1875 three Polar bears who appeared to pasture in all peacefulness among the rocks, and did not allow themselves to be disturbed by the enormous log-fire of driftwood we lighted on the strand to make our

coffee. Here were found for the last time during our journey up the river actual marine animals: Appendicularia, Clio, medusæ, large beroids, &c. Large bushy plants were still completely wanting, but the vegetable world already began to assume a stamp differing from the Arctic Ocean flora proper. A short distance south of Yefremov Kamen begins the veritable *tundra*, a woodless plain, interrupted by no mountain heights, with small lakes scattered over it, and narrow valleys crossing



RIVER VIEW ON THE YENISEJ.
(From a drawing by A. N. Lundström.)

it, which often make an excursion on the apparently level plain exceedingly tiresome.

As is the case with all the other Siberian rivers running from south to north,[1] the western strand of the Yenisej, wherever it

[1] It is the general rule that where rivers flow through loose, earthy strata in a direction deviating considerably from that of the parallels of latitude, the right bank, when one stands facing the mouth of the river, is

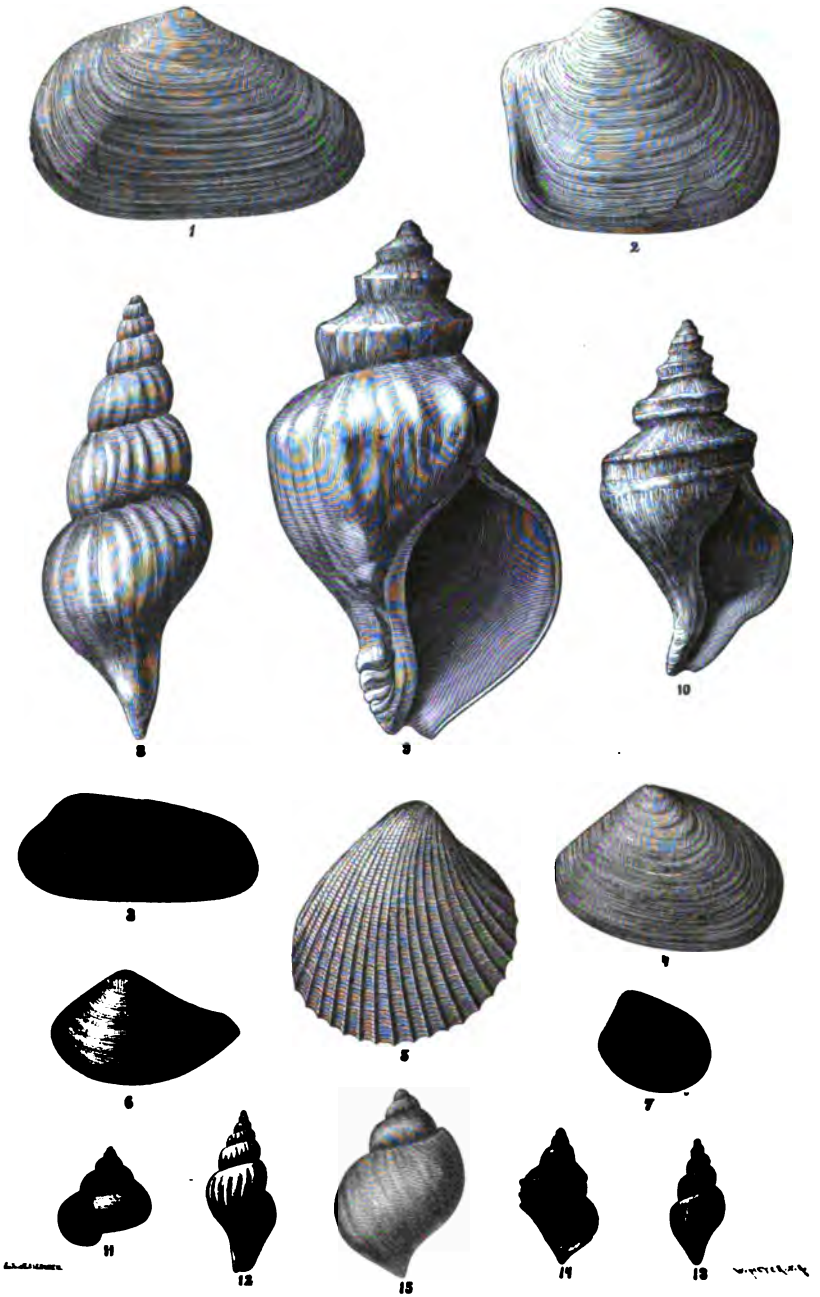
is formed of loose, earthy layers, is also quite low and often marshy, while on the other hand the eastern strand consists of a steep bank, ten to twenty metres high, which north of the limit of trees is distributed in a very remarkable way into pyramidal pointed mounds. Numerous shells of crustacea found here, belonging to species which still live in the Polar Sea, show that at least the upper earthy layer of the *tundra* was deposited in a sea resembling that which now washes the north coast of Siberia.[1]

The *tundra* itself is in summer completely free of snow, but at a limited depth from the surface the ground is continually frozen. At some places the earthy strata alternate with strata of pure, clear ice. It is in these frozen strata that complete carcases of elephants and rhinoceroses have been found, which have been protected from putrefaction for hundreds of thousands of years. Such *finds*, however, are uncommon, but on the other hand single bones from this primeval animal world occur

high, and the left low. The cause of this is the globular form of the earth and its rotation, which gives rivers flowing north a tendency towards the east, and to rivers flowing south a tendency to the west. This tendency is resisted by the bank, but it is gradually eaten into and washed away by degrees, so that the river bed, in the course of thousands of years, is shifted in the direction indicated.

[1] As specimens of the sub-fossil mollusc fauna of the *tundra* some of the common species are delineated on the opposite page. These are:—

1. *Mya arenaria*, Lin. ⅔ of natural size.
2. *Mya truncata*, Lin. var. *Uddevallensis*, Forbes. ⅔.
3. *Saxicava pholadis*, Lin. ⅔.
4. *Tellina lata*, Gmel. ⅔.
5. *Cardium ciliatum*, Fabr. ⅔.
6. *Leda pernula*, Müll. var. *buccata*, Steenstr. Natural size.
7. *Nucula expansa*, Reeve. Nat. size.
8. *Fusus Kröyeri*, Möll. ⅔.
9. *Fusus fornicatus*, Reeve. ½.
10. *Fusus tornatus*, Gould. ⅔.
11. *Margarita elegantissima*, Bean. Natural size.
12. *Pleurotoma plicifera*, Wood. Natural size.
13. *Pleurotoma pyramidalis*, Ström. 1½.
14. *Trichotropis borealis*, Brod. 1½.
15. *Natica helicoides*, Johnst. Nat. size.



SUB-FOSSIL MARINE CRUSTACEA FROM THE TUNDRA.

in rich abundance, and along with them masses of old drift-wood, originating from the Mammoth period, known by the Russian natives of Siberia under the distinctive name of "Noah's wood." Besides there are to be seen in the most recent layer of the Yenesej *tundra*, considerably north of the present limit of actual trees, large tree-stems with their roots fast in the soil, which show that the limit of trees in the Yenesej region, even during our geological period, went further north than now, perhaps as far as, in consequence of favourable local circumstances, it now goes on the Lena.

On the slopes of the steep *tundra* bank and in several of the *tundra* valleys there is an exceedingly rich vegetation, which already, only 100 kilometres south of Yefremov Kamen, forms actual thickets of flowering plants, while the *tundra* itself is overgrown with an exceedingly scanty carpet, consisting more of mosses than of grasses. Salices of little height go as far north as Port Dickson (73° 30′ N.L,), the dwarf birch (*Betula nana*, L.) is met with, though only as a bush creeping along the ground, at Cape Schaitanskoj (72° 8′ N.L.); and here in 1875, on the ice-mixed soil of the *tundra*, we gathered ripe cloudberries. Very luxuriant alders (*Alnaster fruticosus*, LEDEB.) occur already at Mesenkin (71° 28′ N.L.), and the Briochov Islands (70° to 71° N.L.), are in several places covered with rich and luxuriant thickets of bushes. But the limit of trees proper is considered to begin first at the great bend which the river makes in 69° 40′ N.L., a little north of Dudino. Here the hills are covered with a sort of wood consisting of half-withered, grey, moss-grown larches (*Larix sibirica*), which seldom reach a height of more than seven to ten metres, and which much less deserve the name of trees than the luxuriant alder bushes which grow nearly 2° farther north. But some few miles south of this place, and still far north of the Arctic Circle, the pine forest becomes tall. Here begins a veritable forest, the greatest the earth has to show, extending with little interruption from

the Ural to the neighbourhood of the Sea of Ochotsk, and from the fifty-eighth or fifty-ninth degree of latitude to far north of the Arctic Circle, that is to say, about one thousand kilometres from north to south, and perhaps four times as much from east to west. It is a primeval forest of enormous extent, nearly untouched by the axe of the cultivator, but at many places devastated by extensive forest fires.

On the high eastern bank of the Yenisej the forest begins immediately at the river bank. It consists principally of pines: the cembra pine (*Pinus Cembra*, L.), valued for its seeds, enormous larches, the nearly awl-formed Siberian pine (*Pinus sibirica*, LEDEB.), the fir (*Pinus obovata*, TURCZ.), and scattered trees of the common pine (*Pinus sylvestris*, L.). Most of these already north of the Arctic Circle reach a colossal size, but in such a case are often here, far from all forestry, grey and half-dried up with age. Between the trees the ground is so covered with fallen branches and stems, only some of which are fresh, the others converted into a mass of wood-mould held together only by the bark, that there one willingly avoids going forward on an unbroken path. If that must be done, the progress made is small, and there is constant danger of breaking one's bones in the labyrinth of stems. Nearly everywhere the fallen stems are covered, often concealed, by an exceedingly luxuriant bed of mosses, while on the other hand tree-lichens, probably in consequence of the dry inland climate of Siberia, occur sparingly. The pines, therefore, want the shaggy covering common in Sweden, and the bark of the birches which are seen here and there among the pines is distinguished by an uncommon blinding whiteness.

The western bank of the Yenesej consists, like the innumerable islands of the river, for the most part of lowlying and marshy stretches of land, which at the season of the spring floods are overflowed by the river and abundantly manured with its mud. In this way there is formed here a fertile tract of

meadow covered partly with a grassy turf untouched by the scythe, partly with a very peculiar bush vegetation, rising to a height of eight metres, among which there are to be found a number of families of plants well known by us in Sweden, as Impatiens, Urtica, Sonchus, Heracleum, &c., but in gigantic forms unknown at home. Often a dense thicket of a willow (*Salix vitellenia*, L.), whose straight, branchless stems resemble at a distance the bamboo woods of the south, alternates with level, grassy carpets of a lively green and small streams in such a way as gives the whole the appearance of the most smiling park carefully kept free of fallen branches and dry grass. It is the river water which in spring has played the gardener's part in these parks, seldom trodden by the foot of man and endlessly rich in the most splendid greenery. Near the river there are also to be found carpets of a uniform green, consisting of a short kind of Equisetum, unmixed with any other plants, which forms a "gazon," to which no nobleman's country seat can show a match. The drawback is, that a stay in these regions during summer is nearly rendered impossible by the enormous number of mosquitoes with which the air is infested.

A table drawn up by Dr. ARNELL, to be found in *Redogörelse för de svenska expeditionerna till mynningen af Jenisej år 1876*,[1] shows the distribution of the most important varieties of trees. From it we see that on the Yenesej the birch (*Betula odorata*, BECHST.), the fir (*Pinus obovata*, TURCZ.), the larch (*Pinus larix*, L.), and the juniper (*Juniperus communis*, L.), go to 69° 35′ N.L. (that is to say to the latitude of Tromsoe); the sallow (*Salix caprea*, L.) to 68° 55′; the bird's cherry (*Prunus padus*, L.), and the Siberian pine (*Pinus sibirica*, LEDEB.), to 66° 30′; the aspen (*Populus tremula*, L.) to 65° 55′ (the latitude of Haparanda); the pine (*Pinus sylvatica*, L.) to 65° 50′, &c.

In the middle of the forest belt the wood appears to cover the whole land without interruption, there being, unless

[1] *Bihang till Vet. Akad. Handl.* Bd. iv. No. 11, p. 42.

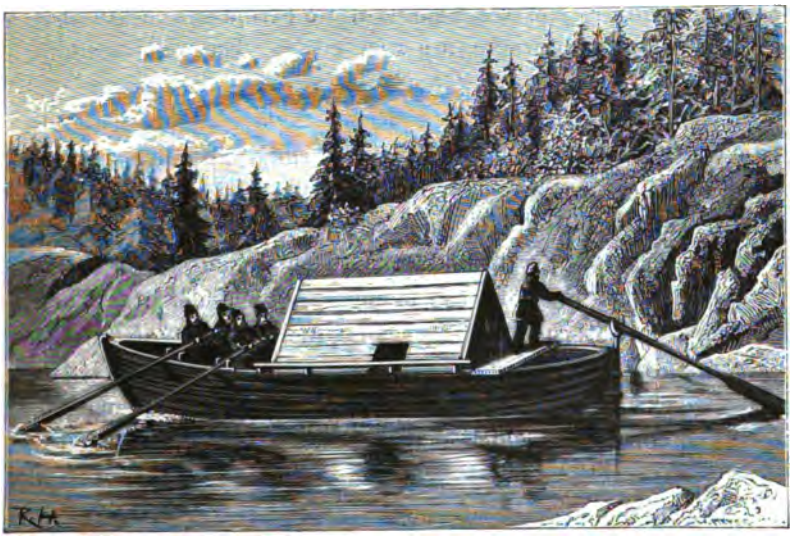
exceptionally, no open places. But towards the north the forest passes into the treeless *tundra* through bare spots occurring here and there, which gradually increase, until trees grow only in valleys and sheltered places, and finally disappear completely. Similar is the passage of the forest to treeless regions (steppes), which at first are here and there bestrewed with more or less detached groups of broad-leaved trees, until they wholly disappear, and the land forms an endless plain, out of whose fertile soil the warm summer sun calls forth a great variety of luxuriant vegetable forms, whose many-hued flowers, often large and splendid, clothe the fields with the richest splendour of colour. Here is the true homeland of many of the show-plants in the flower-gardens of Europe, as, for instance, the peony, the Siberian robinia, the blue iris, &c.

If the Siberian wooded belt forms the most extensive forest in the world, this flower-steppe forms the world's greatest cultivable field, in all probability unequalled in extent and fertility. Without manure and with an exceedingly small amount of labour expended on cultivation, man will year by year draw forth from its black soil the most abundant harvests. For the present, however, this land, with its splendid capabilities for cultivation, has an exceedingly scanty population; and this holds good in a yet higher degree of the forest belt, which is less susceptible of cultivation. At a considerable distance from the rivers it is for the most part an unknown land, where the European seldom or never sets his foot, and where only the native nomad or hunter wanders about. These forests, however, are by no means so rich in game as might be expected, perhaps because the mosquitoes in summer are unendurable by warm-blooded animals.

The main population in the forest belt consists of native nomad or hunting tribes, of which Samoyeds, Ostyaks, Tunguses, and Yakuts are the most numerous. Only along the rivers do we find Russian villages and peasant settlements, placed there for

trading with the natives, for fishing, and at some places for washing gold. Not till we come to the middle of the country is the Russian population more numerous; here it spreads out in a broad belt over the whole of the immense expanse between the Ural and the Angara.

In the farthest north the Russian dwelling-places consist of single cabins built of logs or planks from broken-up lighters,[1]



SIBERIAN RIVER BOAT.

Used by the Norwegian traveller Chr. Hansteen on the river Angara.

and having flat, turf-covered roofs. Such carvings and ornaments as are commonly found on the houses of the well-to-do Russian peasant, and whose artistic outlines indicate that the

[1] Provisions and wares intended for trade with the natives are transported on the Yenisej, as on many other Siberian rivers, down the stream in colossal lighters, built of planks like logs. It does not pay to take them up the river again, on which account, after their lading has been taken out of them, they are either left on the bank to rot or broken up for the timber.

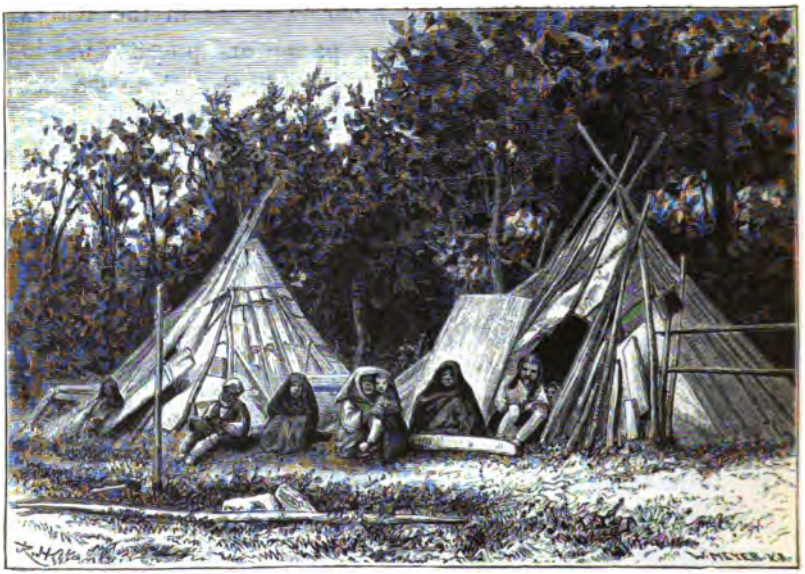
inhabitants have had time to think of something else than the satisfaction of the wants of the moment, are here completely wanting; but further south the villages are larger, and the houses finer, with raised roofs and high gables richly ornamented with wood-carvings. A church, painted in bright colours, generally shows that one of the inhabitants of the village has become rich enough to be at the expense of this ornament to his native place. The whole indicates a degree of prosperity, and the interiors of the houses, if we except the cockroaches, which swarm everywhere, are very clean. The walls are ornamented with numerous, if not very artistic, photographs and lithographs. Sacred pictures, richly ornamented, are placed in a corner, and before them hang several small oil-lamps, or small wax-lights, which are lighted on festive occasions. The sleeping place is formed of a bedstead near the roof, so large that it occupies a half or a third of the room, and at such a height from the floor that one can stand upright under it. There a tropical heat commonly prevails, the occupant of the bed accordingly enjoying an almost constant sweat-bath, which does not prevent him from going out immediately into the open air at a temperature at which mercury freezes. Food is cooked in large baking ovens, which are fired daily for that purpose, and at the same time heat the cabin. Fresh bread is baked every day, and even for the poor a large tea-urn (*samovar*) is an almost indispensable household article. The foreigner is certain to receive a hearty and friendly welcome when he crosses the threshold, and if he stays a short time in the cabin he will generally, whatever time of the day it be, find himself drinking a glass of tea with his host. The dress everywhere closely resembles the Russian: for the rich, wide velvet trousers stuck into the boots, a shirt showily embroidered with silver thread, and a large caftan often lined with fur; for the poor, if not too ragged, the same cut, but the cloth inferior, dirty, and torn. During winter, however, for going out of doors, the Samoyed

pesk is said to be common to high and low, Russian and native, settled and nomad.

In my journey up the Yenesej in 1875 I met with only a few persons in these regions who had been exiled thither for political reasons, but on the other hand very many exiled criminals of the deepest dye—murderers, thieves, forgers, incendiaries, &c. Among them were also some few Fins and even a Swede, or at least one who, according to his own statement in broken Swedish, had formerly served in the King's Guard at Stockholm. Security of person and property was in any case complete, and it was remarkable that there did not appear to be any proper distinction of caste between the Russian-Siberian natives and those who had been exiled for crime. There appeared even to be little interest in ascertaining the crime—or, as the customary phrase appears to be here, the "misfortune"—which caused the exile. On making inquiry on this point I commonly got the answer, susceptible of many interpretations, "for bad behaviour." We found a peculiar sort of criminal colony at Selivaninskoj, a very large village situated on the eastern bank of the Yenesej in about the latitude of Aavasaksa. My journal of the expedition of 1875 contains the following notes of my visit to this colony.

The orthodox Russian church, as is well known, is tolerant towards the professors of foreign religions—Lutherans, Catholics, Jews, Mohammedans, Buddhists, Shamans, &c.; but, on the other hand, in complete correspondence with what took place in former times within the Protestant world, persecutes sectaries within its own pale, with temporal punishments here upon earth and with threatenings of eternal in another world. Especially in former times a great many sectaries have been sent to Siberia, and therefore there are sometimes to be found there peculiar colonies enjoying great prosperity, exclusively inhabited by the members of a certain sect. Such is the Skopt colony at Selivaninskoj, in connection with which, however, it may be remarked

that the nature of the religious delusion in this case accounts for the severity of the law or the authorities. For, on the ground of a text in the Gospel of Matthew interpreted in a very peculiar way, all Skoptzi subject themselves to a mutilation, in consequence of which the sect can only exist by new proselytes; and remarkably enough, these madmen, notwithstanding all persecution, or perhaps just on that account, actually still



OSTYAK TENT.
(After a Photograph.)

gain followers. A large number of the Skoptzi were Fins from Ingermanland, with whom I could converse without difficulty. They had, through industry and perseverance, succeeded in creating for themselves a certain prosperity, were hospitable and friendly, and bore their hard fate with resignation. They would not themselves kill any warm-blooded animal, for it was "a sin to kill what God had created;" which did not hinder them from

TOWING WITH DOGS ON THE YENISEJ.

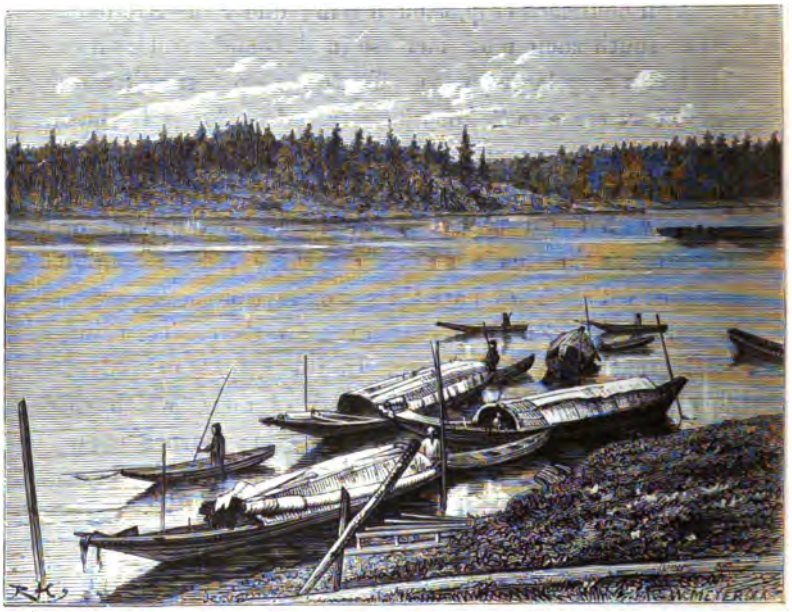
The boat *Lusa* with the Swedish Land Expedition of 1876 on board. (After a drawing by Hj. Théel.)

catching and eating fish, and from selling to us, who in any case were lost beings, a fine fat ox, on condition that our own people should slaughter it. Their abstinence from some kinds of animal food had besides the good result of inducing them to devote themselves to the cultivation of the soil. Round about their cabins accordingly there were patches of land growing potatoes, turnips, and cabbage, which at least that year yielded an abundant crop, though lying under the Arctic circle. Farther south such plots increase in size, and yield rich crops, at least, of a very large potato. There is no proper cultivation of grain till we come to Sykobatka, situated in 60° N.L., but in a future, when forests and mosses are diminished, a profitable agriculture will be carried on far to the northward.

Along with the dwellings of the Russians, the tents of the natives, or, as the Russians call them, "the Asiatics," are often to be met with. They have the same shape as the Lapp "kota." The Samoyed tent is commonly covered with reindeer skins, the Ostyak tent with birch bark. In the neighbourhood of the tent there are always large numbers of dogs, which during winter are employed for general carrying purposes, and in summer for towing boats up the river—a means of water transport which greatly astonished the Norwegian sailors with whom I travelled up the river in 1875. To see people travelling in a boat drawn by dogs appeared to them more remarkable than the Kremlin of Moscow, or the bells of Kiev. For such a journey a sufficient number of dogs are harnessed to a long line, one end of which is fastened to the stem of the boat. The dogs then go along the level bank, where they make actual footpaths. The boat being of light draught is kept afloat at a sufficient distance from land partly by means of the rudder which is managed by a person sitting in the stem of the boat, and partly by poling from the fore. Small boats are often hollowed out of a single tree-stem, and may notwithstanding, thanks to the size which some of the pines attain in those

regions, be very roomy, and of a very beautiful shape. The dogs strongly resemble the Eskimo dogs in Greenland, which are also used as draught animals.

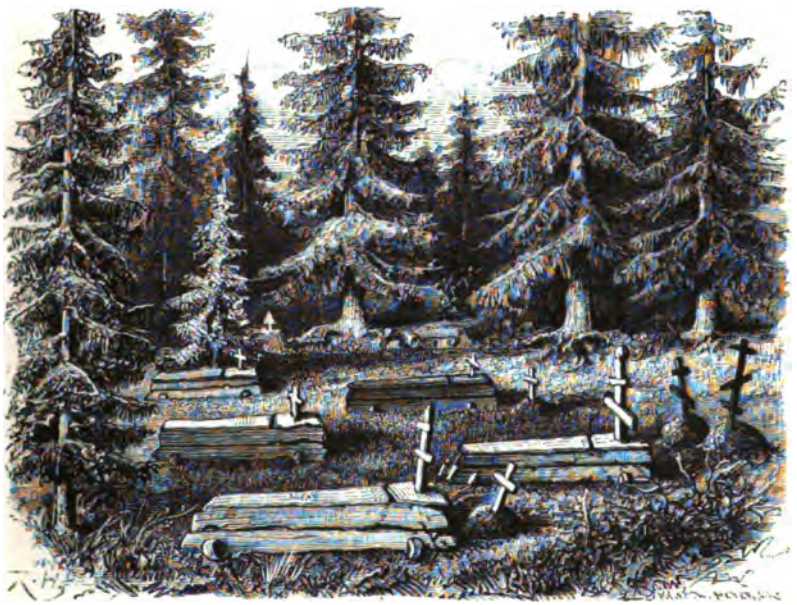
Most of the natives who have come into close contact with the Russians are said to profess the Christian religion. That many heathen customs, however, still adhere to them is shown, among



FISHING BOATS ON THE OB.
(After a Photograph.)

other things, by the following incident: At a *simovie* where we landed for some hours on the 16th Sept. we found, as is common, a burying-place in the forest near the dwelling houses. The corpses were placed in large coffins above ground, at which almost always a cross was erected. In one of the crosses a sacred picture was inserted, which must be considered a further

proof that a Christian rested in the coffin. Notwithstanding this, we found some clothes, which had belonged to the departed, hanging on a bush beside the grave, together with a bundle containing food, principally dried fish. At the graves of the richer natives the survivors are even said to place along with food some rouble notes, in order that the departed may not be altogether without ready money on his entrance into the other world.



GRAVES IN THE PRIMEVAL FOREST OF SIBERIA.
(After a drawing by Hj. Théel.)

Right opposite the village Nasimovskoj is a gold-digger's deserted "residence," named Yermakova after the first conqueror of Siberia. The building owed its origin to the discovery of sand-beds rich in gold, occupying a pretty extensive area east of the Yenisej, which for a time had the repute of being the richest gold territory in the world. Here in a short time enormous fortunes were made; and accounts of the

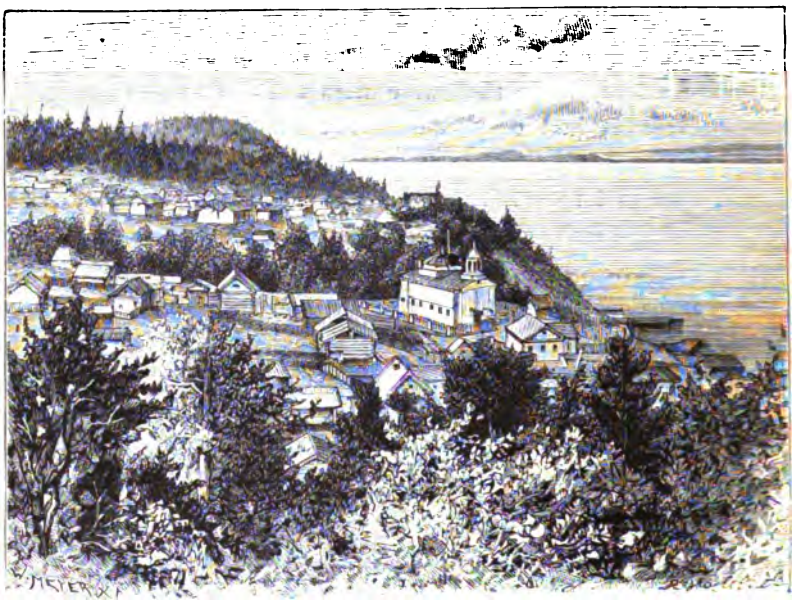
hundreds of poods which one or another yearly reaped from the sand-beds, and the fast reckless life led by those to whom fortune dealt out the great prizes in the gold-digging lottery, still form a favourite topic of conversation in the region. A rise in the value of labour and a diminished production of the noble metal have, however, since led to the abandonment of a large number of the diggings that formerly were most productive; others now scarcely pay the expense of the working. Many of the gold-diggers who were formerly rich, in the attempt to win more have been impoverished, and have disappeared; others who have succeeded in retaining their "pood of gold"—that is the mint unit which the gold-diggers prefer to use in their conversation—have removed to Omsk, Krasnojarsk, Moscow, Petersburg, Paris, &c. The gold-diggers' residences stand, therefore, now deserted, and form on the eastern bank of the river a row of half-decayed wooden ruins surrounded by young trees, after which in no long time only the tradition of the former period of prosperity will be found remaining. In one respect indeed the gold-diggers have exerted a powerful influence on the future of the country. For it was through them that the first pioneers were scattered in the wilderness, the first seed sown of the cultivation of the region.

In 1875 there were only two steamers on the Yenisej. These were neither passenger nor cargo boats, but rather movable commercial stores, propelled by steam. The fore-saloon formed a shop provided with a desk, and shelves on which were to be seen cloths, iron wares, guns, ammunition, tobacco, tea, matches, sugar, brightly coloured copper engravings or lithographs, &c. In the after-saloon was enthroned, among brandy casks, purchased furs, and other precious or delicate wares, he who had the command on board, a kind and friendly merchant, who evidently did not concern himself much with the work of the sailors, but rather with trade and the making of bargains, and who was seldom called by the crew captain (*kapitan*), but gene-

rally master (*hosain*). After the steamer, or floating commercial store, there was towed one or two *lodjas*, which served as magazines, in which meal and salt and other heavy goods were stored, the purchased fish were salted and looked after, fresh bread baked for the numerous crew, &c. And as there was not a single jetty to be found the whole way between Yenisejsk and the sea, both the steamer and the *lodjas*, in order to be able to load and deliver goods at any point, had a large number of boats and lighters in tow. No place was set apart for passengers, but travellers were received in a friendly and hospitable manner when they came on board, where they were then allowed to look out for themselves as best they could. The nautical command was held by two mates or pilots of a stately and original appearance, who, clad in long caftans, sat each in his watch on a chair at the wheel, generally without steering, mostly smoking a cigarette made of coarse paper and, with the most careless appearance in the world, exchanging jests with those who were going down the river. The prohibition of taking away the attention of the steersman from his work by conversation was thus not in force hereabouts. A man stood constantly in the fore, uninterruptedly testing the depth with a long pole. For in order to avoid the strong current of the main stream the course was always shaped as near the shore as possible, often so near that one could almost jump ashore, and my own Nordland boat, which was towed by the side of the steamer, was occasionally drawn over land. It will be seen from this of how light draught the steamer was.

Siberia, especially the river territory of the Yenisej and the Lena, possesses rich coal seams, which probably extend under considerable portions of the Siberian plain, but are yet unworked and have attracted little attention. The river steamers accordingly are fired, not with coal, but with wood, of which, if I remember right, 180 fathoms went to the voyage of the steamer *Alexander* up the river. As the vessel could carry only a small portion of this quantity of wood at one time, frequent halts were

necessary, not only for trading with the natives, but also for taking fuel on board. In addition to this, the weak engine, *although the safety valves were overloaded when necessary with lead weights,* was sometimes unable to make head with all the vessels in tow against a current which at some places was very rapid, and often, in the attempt to find still water near the river bank, the steamer ran aground, notwithstanding the continual "ladno"



CHURCH VILLAGE ON A SIBERIAN RIVER.
(After a Photograph.)

cry of the poling pilot standing in the fore. It made so slow progress on this account that the passage from Saostrovskoj to Yenisejsk occupied a whole month.

The two main arms into which the Yenisej is divided south of Yenisejsk are too rapid for the present Yenisej steamers to ascend them, while, as has been already stated, there is no

difficulty in descending these rivers from the Selenga and the Baikal Lake on the one hand, and from the Minusinsk region abounding in grain on the other. The banks here consist, in many places, of high rocky ridges covered with fine forests, with wonderfully beautiful valleys between them, covered with luxuriant vegetation.

What I have said regarding the mode of travelling up the Yenisej refers to the year 1875, in which I went up the river accompanied by two Swedish naturalists and three Norwegian seamen. It was then by no means unknown, for scientific men such as HANSTEEN (1829), CASTRÉN (1846), MIDDENDORF (winter journeys in 1843 and 1844), and SCHMIDT (1866), had travelled hither and communicated their observations to the scientific world in valuable works on the nature and people of the region. But the visits of the West-European still formed rare exceptions; no West-European commercial traveller had yet wandered to those regions, and into the calculations of the friendly masters of the Yenisej river steamers no import of goods from, or export of goods to, Europe had ever entered. All at once a new period seemed to begin. If the change has not gone on so fast as many expected, life here, however, is more than it was at one time, and every year the change is more and more noticeable. It is on this account that I consider these notes from the journey of 1875 worthy of being preserved.

CHAPTER IX.

The New Siberian Islands—The Mammoth—Discovery of Mammoth and Rhinoceros mummies—Fossil Rhinoceros horns—Stolbovoj Island—Liachoff's Island—First discovery of this island—Passage through the sound between this island and the mainland—Animal life there—Formation of ice in water above the freezing point—The Bear Islands—The quantity and dimensions of the ice begin to increase—Different kinds of sea-ice—Renewed attempt to leave the open channel along the coast—Lighthouse Island—Voyage along the coast to Cape Schelagskoj—Advance delayed by ice, shoals, and fog—First meeting with the Chukches—Landing and visits to Chukch villages—Discovery of abandoned encampments—Trade with the natives rendered difficult by the want of means of exchange—Stay at Irkaipi—Onkilon graves—Information regarding the Onkilon race—Renewed contact with the Chukches—Kolyutschin Bay—American statements regarding the state of the ice north of Behring's Straits—The *Vega* beset.

AFTER the parting the *Lena* shaped her course towards the land; the *Vega* continued her voyage in a north-easterly direction towards the new Siberian Islands.

These have, from the time of their discovery, been renowned among the Russian ivory collectors for their extraordinary richness in tusks and portions of skeletons of the extinct northern species of elephant known by the name of *mammoth*.

We know by the careful researches of the academicians PALLAS, VON BAER, BRANDT, VON MIDDENDORFF, FR. SCHMIDT, &c., that the mammoth was a peculiar northern species of elephant with a covering of hair, which, at least during certain seasons of the year, lived under natural conditions closely resembling those which now prevail in middle and even in northern Siberia. The widely extended grassy plains and forests of North Asia

were the proper homeland of this animal, and there it must at one time have wandered about in large herds.

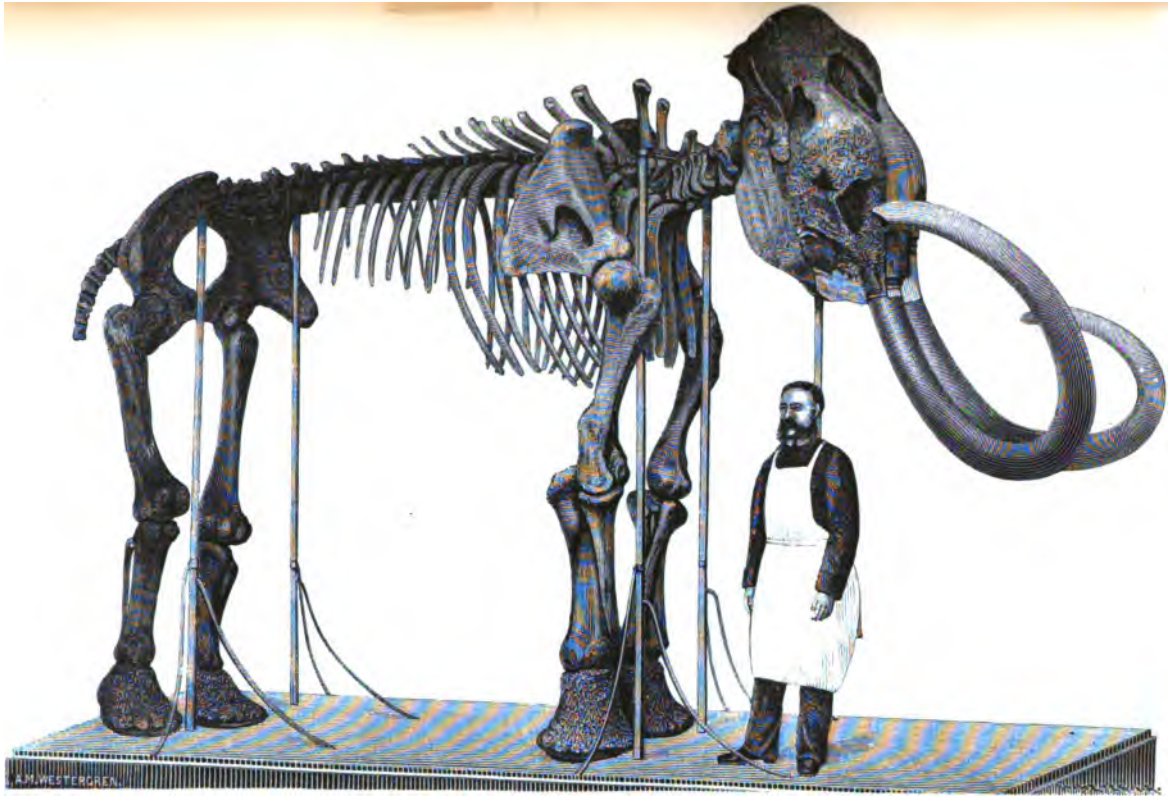
The same, or a closely allied species of elephant, also occurred in North America, in England, France, Switzerland, Germany, and North Russia. Indeed, even in Sweden and Finland inconsiderable mammoth remains have sometimes been found.[1] But while in Europe only some more or less inconsiderable remains of bones are commonly to be found, in Siberia we meet not only with whole skeletons, but also whole animals frozen in the earth, with solidified blood, flesh, hide, and hair. Hence we may draw the conclusion that the mammoth died out, speaking geologically, not so very long ago. This is besides confirmed by a remarkable antiquarian discovery made in France. Along with a number of roughly worked flint flakes, pieces of ivory were found, on which, among other things, a mammoth with trunk, tusks, and hair was engraved in rough but unmistakable lineaments, and in a style resembling that which distinguishes the Chukch drawings, copies of which will be found further on in this work. This drawing, whose genuineness appears to be proved, surpasses in age, perhaps a hundredfold, the oldest monuments that Egypt has to show, and forms a remarkable proof that the mammoth, the original of the drawing, lived in Western Europe contemporaneously with man. The mammoth remains are thus derived from a gigantic animal form, living in former times in nearly all the lands now civilized, and whose carcase is not yet everywhere completely decomposed. Hence the great and intense interest which attaches to all that concerns this wonderful animal.

If the interpretation of an obscure passage in Pliny be correct, mammoth ivory has, from the most ancient times, formed a

[1] Further information on this point is given by A. J. Malmgren in a paper on the occurrence and extent of mammoth-finds, and on the conditions of this animal's existence in former times (*Finska Vet.-Soc. Förhandl.* 1874—5).

valued article of commerce, which, however, was often mistaken for the ivory of living elephants and of the walrus. But portions of the skeleton of the mammoth itself are first described in detail by WITSEN, who during his stay in Russia in 1686 collected a large number of statements regarding it, and at least in the second edition of his work gives good drawings of the under jaw of a mammoth and the cranium of a fossil species of ox, whose bones are found along with the remains of the mammoth (WITSEN, 2nd. edit. p. 746). But it appears to have escaped Witsen, who himself considered mammoth bones to be the remains of ancient elephants, and who well knew the walrus, that in a number of the accounts which he quotes, the mammoth and the walrus are clearly mixed up together, which is not so wonderful, as both are found on the coast of the Polar Sea, and both yielded ivory to the stocks of the Siberian merchants. In the same way all the statements which the French Jesuit, AVRIL, during his stay in Moscow in 1686, collected regarding the amphibious animal, *Behemoth*, occurring on the coast of the Tartarian Sea, (Polar Sea) refer not to the mammoth, as some writers, HOWORTH[1] for example, have supposed, but to the walrus. The name mammoth, which is probably of Tartar origin, Witsen appears to wish to derive from Behemoth, spoken of in the fortieth chapter of the Book of Job. The first mammoth tusk was brought to England in 1611, by JOSIAS LOGAN. It was purchased in the region of the Petchora, and attracted great attention, as appears from Logan's remark in a letter to Hakluyt, that one would not have dreamed to find such wares in the region of the Petchora (*Purchas*, iii. p. 546). As Englishmen at that time visited Moscow frequently, and for long periods, this remark appears to indicate that fossil ivory first became

[1] Compare Ph. Avril, *Voyage en divers états d'Europe et d'Asie entrepris pour découvrir un nouveau chemin à la Chine*, etc., Paris, 1692, p. 209. Henry H. Howorth, "The Mammoth in Siberia" (*Geolog. Mag.* 1880, p. 408).

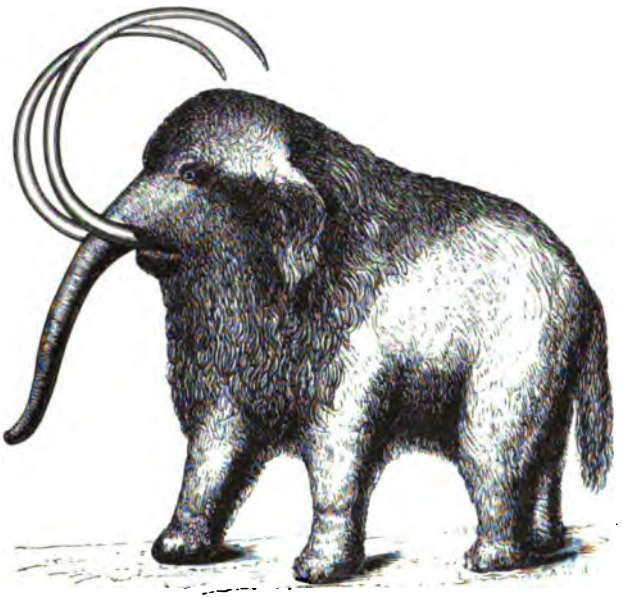


MAMMOTH SKELETON IN THE IMPERIAL MUSEUM OF THE ACADEMY OF SCIENCES IN ST. PETERSBURG.

After a Photograph communicated by the Academician Friedrich Schmidt in St. Petersburg.

known in the capital of Russia some time after the conquest of Siberia.

I have not, indeed, been successful during the voyage of the *Vega* in making any remarkable discovery that would throw light on the mode of life of the mammoth,[1] but as we now sail forward between shores probably richer in such remains than any



RESTORED FORM OF THE MAMMOTH.
After JUKES, *The Student's Manual of Geology*, Edinburgh, 1862.

other on the surface of the globe, and over a sea, from whose bottom our dredge brought up, along with pieces of driftwood, half-decayed portions of mammoth tusks, and as the savages with whom we came in contact, several times offered us very fine mammoth tusks or tools made of mammoth ivory, it may

[1] As will be stated in detail further on, there were found during the *Vega* expedition very remarkable sub-fossil animal remains, not of the mammoth, however, but of various different species of the whale.

not perhaps be out of place here to give a brief account of some of the most important mammoth *finds* which have been preserved for science. We can only refer to the discovery of mammoth *mummies*,[1] for the *finds* of mammoth tusks sufficiently well preserved to be used for carving are so frequent as to defy enumeration. Middendorff reckons the number of the tusks, which yearly come into the market, as at least a hundred pairs,[2] whence we may infer, that during the years that have elapsed since the conquest of Siberia useful tusks from more than 20,000 animals have been collected.

The discovery of a mammoth-*mummy* is mentioned for the first time in detail in the sketch of a journey which the Russian ambassador EVERT YSSBRANTS IDES, a Dutchman by birth, made in 1692 through Siberia to China. A person whom Yssbrants Ides had with him during his journey through Siberia, and who travelled every year to collect mammoth ivory, assured him that he had once found a head of this animal in a piece of frozen earth which had tumbled down. The flesh was putrefied, the neck-bone was still coloured by blood, and some distance from the head a frozen foot was found.[3] The foot was taken to Turuchansk, whence we may infer that the *find* was made on the Yenisej. Another time the same man found a pair of tusks weighing together twelve poods or nearly 200 kilogram. Ides' informant further stated, that while the heathen Yakuts, Tun-

[1] The word *mummies* is used by Von Middendorff to designate carcases of ancient animals found in the frozen soil of Siberia.

[2] The calculation is probably rather too low than too high. The steamer alone, in which I travelled up the Yenisej in 1875, carried over a hundred tusks, of which however the most were blackened, and many were so decayed that I cannot comprehend how the great expense of transport from the *tundra* of the Yenisej could be covered by the value of this article. According to the statement of the ivory dealers the whole parcel, good and bad together, was paid for at a common average price.

[3] Notices of yet other *finds* of mammoth carcases occur, according to Middendorff (*Sib. Reise*, IV. i. p. 274) in the scarce and to me inaccessible first edition of Witsen's *Noord en Oost Tartarye* (1692, Vol. II. p. 473).

guses, and Ostyaks, supposed that the mammoth always lived in the earth and went about in it, however hard the ground might be frozen, also that the large animal died when it came so far up that it saw or smelled the air; the old Russians living in Siberia were of opinion that the mammoth was an animal of the same kind as the elephant, though with tusks somewhat more bent and closer together; that before the Flood Siberia had been warmer than now, and elephants had then lived in numbers there; that they had been drowned in the Flood, and afterwards, when the climate became colder, had frozen in the river mud.[1]

The folk-lore of the natives regarding the mode of life of the mammoth under ground is given in still greater detail in J. B. MÜLLER'S *Leben und Gewonheiten der Ostiaken unter dem Polo arctico wohnende*, &c. Berlin, 1720 (in French in *Recueil de Voiages au Nord*, Amsterdam, 1731–38, Vol. VIII. p. 373). According to the accounts given by Müller, who lived in Siberia as a Swedish prisoner of war,[2] the tusks formed the animal's horns. With these, which were fastened above the eyes and were movable, the animal dug a way for itself through the clay and mud, but when it came to sandy soil, the sand ran together so that the mammoth stuck fast and perished. Müller further states, that many assured him that they themselves had seen such animals on the other side of Beresovsk in large grottos in the Ural mountains (*loc. cit.* p. 382).

KLAPROTH received a similar account of the mammoth's way of life from the Chinese in the Russo-Chinese frontier and trading town Kyachta. For mammoth ivory was considered to be tusks of the giant rat *tien-shu*, which is only found in the cold

[1] E. Ysbrants Ides, *Dreyjärige Reise nach China*, etc., Frankfort, 1707, p. 55. The first edition was published in Amsterdam, in Dutch, in 1704.

[2] Strahlenberg in *Das Nord- und Ostliche Theil von Europa und Asia*, Stockholm, 1730, p. 393, also gives a large number of statements regarding the fossil Siberian ivory, and mentions that the distinguished Siberian traveller Messerschmidt found a complete skeleton on the river Tom.

regions along the coast of the Polar Sea, avoids the light, and lives in dark holes in the interior of the earth. Its flesh is said to be cooling and wholesome. Some Chinese literati considered that the discovery of these immense earth rats might even explain the origin of earthquakes.[1]

It was not until the latter half of the last century that a European scientific man had an opportunity of examining a similar *find*. In the year 1771 a complete rhinoceros, with flesh and hide, was uncovered by a landslip on the river Wilui in 64° N.L. Its head and feet are still preserved at St. Petersburg. All the other parts were allowed to be destroyed for want of means of transport and preservation.[2] What was taken away showed that this primeval rhinoceros (*Rhinoceros antiquitatis* Blumenbach) had been covered with hair and differed from all now living species of the same family, though strongly resembling them in shape and size. Already, long before the horns of the fossil rhinoceros had attracted the attention of the natives, pieces of these horns were used for the same purposes for which the Chukches employ strips of whalebone, viz. to increase the elasticity of their bows. They were considered at the same time to exert a like beneficial influence on the arrow, tending to make it hit the mark, as, according to the hunter's superstition among ourselves in former days, some cat's claws and owl's eyes placed in the bullet mould had on the ball. The natives believed that the crania and horns of the rhinoceros found along with the remains of the mammoth belonged to

[1] Tilesius, *De skeleto mammonteo Sibirico* (*Mém. de l'Acad. de St. Pétersbourg, T. V. pour l'année 1812*, p. 409). Middendorff, *Sib. Reise*, IV. i. p. 274. Von Olfers, *Die Überreste vorweltlicher Riesenthiere in Beziehung zu Ostasiatischen Sagen und Chinesischen Schriften* (*Abhandl. der Akad. d. Wissensch. zu Berlin aus dem Jahre 1839*, p. 51).

[2] P. S. Pallas, *De reliquiis animalium exoticorum per Asiam borealem repertis complementum* (*Novi commentarii Acad. Sc. Petropolitanæ*, XVII. pro anno 1772, p. 576), and *Reise durch verschiedene Provinzen des Russischen Reichs*, Th. III. St. Petersburg, 1776, p. 97.

gigantic birds, regarding which there were told in the tents of the Yakut, the Ostyak and the Tunguse many tales resembling that of the bird Roc in the *Thousand and One Nights*. Ermann and Middendorff even suppose that such *finds* two thousand years ago gave occasion to Herodotus' account of the Arimaspi

SIBERIAN RHINOCEROS HORN.
Preserved in the Museum at St. Petersburg.

and the gold-guarding dragons (*Herodotus*, Book IV. chap. 27). Certain it is that during the middle ages such "grip-claws" were preserved, as of great value, in the treasuries and art collections of that time, and that they gave rise to many a romantic story in the folk-lore both of the West and East. Even in

this century Hedenström, the otherwise sagacious traveller on the Siberian Polar Sea, believed that the fossil rhinoceros' horns were actual "grip-claws." For he mentions in his oft-quoted work, that he had seen such a claw 20 verschoks (0·9 metre) in length, and when he visited St. Petersburg in 1830, the scientific men there did not succeed in convincing him that his ideas on this subject were incorrect.[1]

A new *find* of a mammoth *mummy* was made in 1787, when the natives informed the Russian travellers SARYTSCHEV and MERK, that about 100 versts below the village Alasejsk, situated on the river Alasej running into the Polar Sea, a gigantic animal had been washed out of the sand beds of the beach in an upright posture, undamaged, with hide and hair. The *find*, however, does not appear to have been thoroughly examined.[2]

In 1799 a Tunguse found on the Tamut Peninsula, which juts out into the sea immediately south-east of the river-arm by which the *Lena* steamed up the river, another frozen-in mammoth. He waited patiently five years for the ground thawing so much as that the precious tusks should be uncovered. The softer parts of the animal accordingly were partly torn in pieces and destroyed by beasts of prey and dogs, when the place was closely examined in 1806 by ADAMS the Academician. Only the head and two of the feet were then almost undamaged. The skeleton, part of the hide, a large quantity of long hair and woolly hair a foot and a half long were taken away. How fresh the carcase was may be seen from the fact that parts of the eye could still be clearly distinguished. Similar remains had been

[1] Hedenström, *Otrywki o Sibiri*, St. Petersburg, 1830, p. 125. Ermann's *Archiv*, Part 24, p. 140.

[2] Compare K. E. v. Baer's paper in *Mélanges Biologiques*, T. V. St. Pétersbourg, 1866, p. 691; Middendorff, IV. i. p. 277; Gavrila Sarytschev's *Achtjährige Reise in nordöstlichen Sibirien*, etc., translated by J. H. Busse, Th. 1, Leipzig, 1805, p. 106.

found two years before, a little further beyond the mouth of the Lena, but they were neither examined nor removed.[1]

A new *find* was made in 1839, when a complete mammoth was uncovered by a landslip on the shore of a large lake to the west of the mouth of the Yenisej, seventy versts from the Polar Sea. It was originally almost entire, so that even the trunk appears to have been preserved, to judge by the statement of the natives that a black tongue as long as a month-old reindeer calf was hanging out of the mouth; but it had, when it was removed in 1842, by the care of the merchant TROFIMOV, been already much destroyed.[2]

Next after Trofimov's mammoth come the mammoth-*finds* of Middendorff and Schmidt. The former was made in 1843 on the bank of the river Tajmur, under 75° N.L.; the latter in 1866 or the Gyda *tundra*, west of the mouth of the Yenisej in 70° 13′ N.L. The soft parts of these *finds* were not so well preserved as those just mentioned. But the *finds* at all events had a greater importance for science, from the localities having been thoroughly examined by competent scientific men. Middendorff arrived at the result that the animal found by him had floated from more southerly regions to the place where it was found. Schmidt on the other hand found that the stratum which contained the mammoth rested on a bed of marine clay, containing shells of high northern species of crustacea which still live in the Polar Sea, and that it was covered with strata of sand alternating with beds, from a quarter to half a foot thick, of decayed remains of plants, which completely correspond with the turf beds which are still formed in the lakes of the *tundra*. Even the very beds of earth and clay in which the bones, pieces of

[1] Adams' account is inserted at p. 431 in the work of Tilesius already quoted. Von Baer gives a detailed account of this and other important *finds* of the same nature in the above-quoted paper in Tome V. of *Mélanges Biologiques*, St. Pétersbourg, pp. 645–740.

[2] Middendorff, IV. 1, p. 272.

hide, and hair of the mammoth *mummy* were enclosed, contained pieces of larch, branches and leaves of the dwarf birch (*Betula nana*), and of two northern species of willow (*Salix glauca* and *herbacea*).[1] It appears from this that the climate of Siberia at the time when these mammoth-carcases were imbedded, was very nearly the same as the present, and as the stream in whose neighbourhood the find was made is a comparatively inconsiderable *tundra* river, lying wholly to the north of the limit of trees, there is no probability that the carcase drifted with the spring ice from the wooded region of Siberia towards the north. Schmidt, therefore, supposes that the Siberian elephant, if it did not always live in the northernmost parts of Asia, occasionally wandered thither, in the same way that the reindeer now betakes itself to the coast of the Polar Sea. VON BRANDT, VON SCHMALHAUSEN, and others, had besides already shown that the remains of food which were found in the hollows of the teeth of the Wilui rhinoceros consisted of portions of leaves and needles of species of trees which still grow in Siberia.[2]

Soon after the mammoth found on the Gyda *tundra* had been examined by Schmidt, similar *finds* were examined by GERHARD VON MAYDELL, at three different places between the rivers Kolyma and Indigirka, about a hundred kilometres from the Polar Sea. With respect to these *finds* I can only refer to a paper by L. VON SCHRENCK in the *Bulletin* of the St. Petersburg Academy, T. XVI. 1871, p. 147.

Under the guidance of natives I collected in 1876 at the confluence of the river Mesenkin with the Yenisej, in 71° 28′ N.L., some fragments of bones and pieces of the hide of a

[1] Friedrich Schmidt, *Wissenschaftliche Resultate der zur Aufsuchung eines Mammuthcadavers ausgesandten Expedition* (*Mém. de l'Acad. de St. Pétersbourg*, Ser. VII. T. XVIII. No. 1, 1872).

[2] Brandt, *Berichte der preussischen Akad. der Wissenchaften*, 1846, p. 224. Von Schmalhausen, *Bull. de l'Acad. de St. Pétersbourg*, T. XXII. p. 291.

mammoth. The hide was 20 to 25 millimetres thick and nearly tanned by age, which ought not to appear wonderful, when we consider that, though the mammoth lived in one of the latest periods of the history of our globe, hundreds of thousands, perhaps millions of years have, however, passed since the animal died to which these pieces of skin once belonged. It was clear that they had been washed by the neighbouring river Mesenkin out of the tundra-bank, but I endeavoured, without success, to discover the original locality, which was probably already concealed by river mud. In the neighbourhood was found a very fine cranium of the musk ox.

A new and important *find* was made in 1877 on a tributary of the Lena, in the circle Werchojansk, in 69° N.L. For there was found there an exceedingly well preserved carcase of a rhinoceros (*Rhinoceros Merckii*, Jaeg.), a different species from the Wilui rhinoceros examined by Pallas. However, before the carcase was washed away by the river, there had only been removed the hair-covered head and one foot.[1] From the *find* Schrenck draws the conclusion that this rhinoceros belonged to a high-northern species, adapted to a cold climate, and living in, or at least occasionally wandering to, the regions where the carcase was found. There the mean temperature of the year is now very low,[2] the winter exceedingly cold (– 63°·2 has been registered) and the short summer exceedingly warm. Nowhere

[1] The *find* is described by Herr Czersky in the Transactions published by the East Siberian division of the St. Petersburg Geographical Society; and subsequently by Dr. Leopold von Schrenck in *Mém. de l'Acad. de St. Pétersbourg*, Ser. VII. T. XXVII. No. 7, 1880.

[2] The mean temperature of the different months is shown in the following table:—

Jan.	Feb.	March	April	May	June	
—48°·9	—47°·2	—33°·9	—14°·0	—0°·40	+13°·4	Of the Year.
July.	Aug.	Sept.	Oct.	Nov.	Dec.	—16°·7
+15°·4	+11°·9	+2°·3	—13°·9	—39°·1	—45°·7	

on earth does the temperature show extremes so widely separated as here. Although the trees in winter often split with tremendous noise, and the ground is rent with the cold, the wood is luxuriant and extends to the neighbourhood of the Polar Sea, where besides, the winter is much milder than farther in the interior. With respect to the possibility of these large animals finding sufficient pasture in the regions in question, it ought not to be overlooked that in sheltered places overflowed by the spring inundations there are found, still far north of the limit of trees, luxuriant bushy thickets, whose newly-expanded juicy leaves, burned up by no tropical sun, perhaps form a special luxury for grass-eating animals, and that *even the bleakest stretches of land in the high north are fertile in comparison with many regions where at least the camel can find nourishment, for instance the east coast of the Red Sea.*

The nearer we come to the coast of the Polar Sea, the more common are the remains of the mammoth, especially at places where there have been great landslips at the river banks when the ice breaks up in spring. Nowhere, however, are they found in such numbers as on the New Siberian Islands. Here Hedenström in the space of a verst saw ten tusks sticking out of the ground, and from a single sandbank on the west side of Liachoff's Island the ivory collectors had, when this traveller visited the spot, for eighty years made their best tusk harvest. That new *finds* may be made there year by year depends on the bones and tusks being washed by the waves out of the sandbeds on the shore, so that after an east wind which has lasted some time they may be collected at low water on the banks then laid dry. The tusks which are found on the coast of the Polar Sea are said to be smaller than those that are found farther south, a circumstance which possibly may be explained by supposing that, while the mammoth wandered about on the plains of Siberia, animals of different ages pastured in company, and that the younger of them, as being more agile and

perhaps more troubled by flies than the older, went farther north than these.

Along with bones of the mammoth there are found on the New Siberian Islands, in not inconsiderable numbers, portions of the skeletons of other animal forms, little known, but naturally of immense importance for ascertaining the vertebrate fauna which lived at the same time with the mammoth on the plains of Siberia, and the New Siberian group of islands is not less remarkable for the "wood-hills," highly enigmatical as to their mode of formation, which Hedenström found on the south coast of the northernmost island. These hills are sixty-four metres high, and consist of thick horizontal sandstone beds alternating with strata of fissile bituminous tree stems, heaped on each other to the top of the hill. In the lower part of the hill the tree stems lie horizontally, but in the upper strata they stand upright, though perhaps not rootfast.[1] The flora and fauna of the island group besides are still completely unknown, and the fossils, among them ammonites with exquisite pearly lustre, which Hedenström brought home from the rock strata on Kotelnoj Island, hold out inducement to further researches, which ought to yield the geologist valuable information as to the former climate and the former distribution of land and sea on the surface of the globe. The knowledge of the hydrography of this region is besides an indispensable condition for judging of the state of the ice in the sea which washes the north coast of Asia. Here lies the single available starting-point for the exploration of the yet altogether unknown sea farther to the north, and from hills on the two northernmost islands Hedenström thought that across the sea to the north-west and north-east he saw obscure outlines of new land, on which no man had yet set his foot. All these circumstances confer on this group of islands

[1] Hedenström, *loc. cit.* p. 128. To find stranded driftwood in an upright position is nothing uncommon.

an uncommon interest in a scientific and geographical respect, and therefore no long time can elapse until a scientific expedition be sent to these regions. Just for this reason I now desired, as a preparation for a future voyage, to wander about here for a couple of days, partly on foot, partly by boat.

The air was calm, but for the most part clouded, the temperature as high as + 4°, the sea clear of ice, the salinity of

STOLBOVOJ ISLAND.
After a drawing by O. Nordquist.

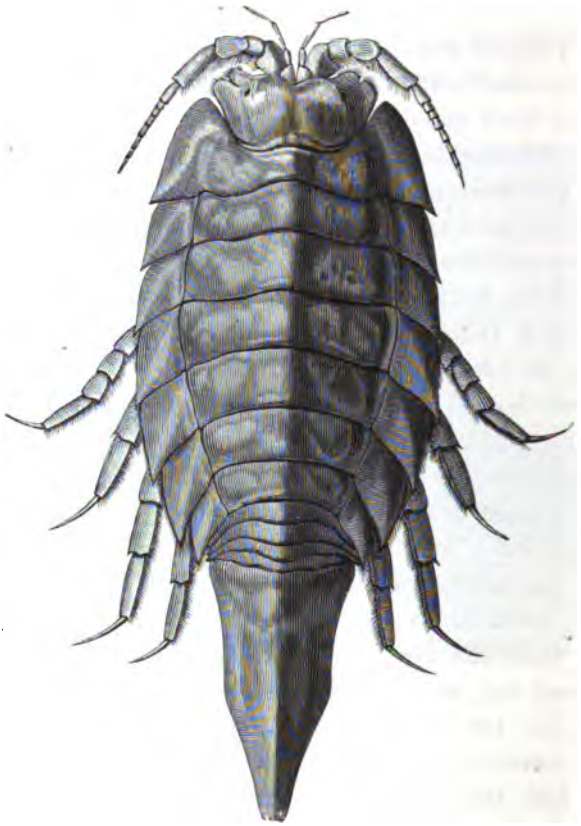
the water 1·8 per cent. with a temperature of + 2° to + 3°. At first we made rapid progress, but after having in the afternoon of the 28th August sighted the westernmost islands, Semenoffskoj and Stolbovoj, the sea became so shallow that for long stretches we were compelled to sail in six to seven metres water. Some very rotten ice, or rather ice sludge, was also met with, which compelled us to make tedious *détours*, and prevented the *Vega* from going at full speed.

The animal life was among the scantiest I had seen during my many travels in the Polar Seas. A few seals were visible. Of birds we saw some terns and gulls, and even far out at sea a pretty large number of phalaropes—the most common kind of bird on the coast of the Asiatic Polar Sea, at least in autumn. Stolbovoj Island was, especially on the north side, high with precipitous shore-cliffs which afforded splendid breeding-places for looms, black guillemots and gulls. At all such cliffs there breed on Spitzbergen millions of sea fowl, which are met with out on the surrounding sea in great flocks searching for their food. Here not a single loom was seen, and even the number of the gulls was small, which indeed in some degree was to be accounted for by the late season of the year, but also by the circumstance that no colony of birds had settled on the rocky shores of the island.

The sea bottom consisted at certain places of hard packed sand, or rather, as I shall endeavour to show farther on, of *frozen* sand, from which the trawl net brought up no animals. At other places there was found a clay, exceedingly rich in *Idothea entomon* and *Sabinei* and an extraordinary mass of bryozoa, resembling collections of the eggs of mollusca.

It was not until the 30th of August that we were off the west side of Ljachoff's Island, on which I intended to land. The north coast, and, as it appeared the day after, the east coast was clear of ice, but the winds recently prevailing had heaped a mass of rotten ice on the west coast. The sea besides was so shallow here, that already at a distance 15′ from land we had a depth of only eight metres. The ice heaped against the west coast of the island did not indeed form any very serious obstacle to the advance of the *Vega*, but in case we had attempted to land there it might have been inconvenient enough, when the considerable distance between the vessel and the land was to be traversed in a boat or the steam launch, and it might even, if a sudden frost had occurred, have become a fetter, which would

have confined us to that spot for the winter. Even a storm arising hastily might in this shallow water have been actually dangerous to the vessel anchored in an open road. The prospect



IDOTHEA ENTOMON, LIN.
From the sea north of the mouth of the Lena.
(Natural size.)

of wandering about for some days on the island did not appear to me to outweigh the danger of the possible failure of the main object of the expedition. I therefore gave up for the time

my intention of landing. The course was shaped southwards towards the sound, of so bad repute in the history of the Siberian Polar Sea, which separates Ljachoff's Island from the mainland.

IDOTHEA SABINEI, KRÖYER.
From the sea off the mouth of the Lena.
(Natural size.)

So far as we could judge at a distance from the appearance of the rocks, Stolbovoj consisted of stratified rocks, Ljachoff's Island, on the contrary, like the mainland opposite, of high hills, much shattered, probably formed of Plutonic stone-masses.

Between these there are extensive plains, which, according to a statement by the land surveyor CHVOINOFF, who by order of the Czar visited the island in 1775, are formed of ice and sand, in which lie imbedded enormous masses of the bones and tusks of the mammoth, mixed with the horns and skulls of some kind of ox and with rhinoceros' horns. Bones of the whale and walrus are not mentioned as occurring there, but "long small screw-formed bones," by which are probably meant the tusks of the narwhal.[1]

All was now clear of snow, with the exception of a few of the deeper clefts between the mountains. No traces of glaciers were visible, not even such small collections of ice as are to be found everywhere on Spitzbergen where the land rises a few hundred feet above the surface of the sea. Nor, to judge by the appearance of the hills, have there been any glaciers in former times, and this is certainly the case on the mainland. The northernmost part of Asia in that case has never been covered by such an ice-sheet as is assumed by the supporters of a general ice age embracing the whole globe.

The large island right opposite to Svjatoinos was discovered in 1770 by LJACHOFF, whose name the island now bears. In 1788 Billings' private secretary, MARTIN SAUER, met with Ljachoff at Yakutsk, but he was then old and infirm, on which account, when Sauer requested information regarding the islands in the Polar Sea, he referred him to one of his companions, ZAITAI PROTODIAKONOFF. He informed him that the discovery was occasioned by an enormous herd of reindeer which Ljachoff, in the month of April 1770, saw going from

[1] Martin Sauer, *An account of a Geographical and Astronomical Expedition to the Northern parts of Russia by Commodore Joseph Billings*, London, 1802, p. 105. The walrus does not occur in the sea between the mouth of the Chatanga and Wrangel Land, and large whales are never seen at the New Siberian Islands, but during Hedenstiöm's stay in these regions three narwhals were enclosed in the ice near the shore at the mouth of the Yana (*Otrywki o Sibiri*, p. 131).

Svjatoinos towards the south, and whose track came over the ice from the north. On the correct supposition that the reindeer came from some land lying to the north, Ljachoff followed the track in a dog-sledge, and thus discovered the two most southerly of the New Siberian Islands, a discovery which was rewarded by the Czarina Catherine II. with the exclusive right to hunt and collect ivory on them.[1]

LJACHOFF'S ISLAND.
After a drawing by O. Nordquist.

Ljachoff states the breadth of the sound between the mainland and the nearest large island at 70 versts or 40′. On Wrangel's map again the breadth is not quite 30′. On the

[1] Martin Sauer, *An account of a Geographical and Astronomical Expedition to the Northern parts of Russia by Commodore Joseph Billings*, London, 1802, p. 103. A. Ermann, *Reise um die Erde*, Berlin, 1833—48, D. 1, B. 2, p. 258. Ermann's statement, that the knowledge of the existence of these islands was concealed from the government up to the year 1806, is clearly incorrect.

mainland side it is bounded by a rocky headland projecting far into the sea, which often formed the turning point in attempts to penetrate eastwards from the mouth of the river Lena, and perhaps just on that account, like many other headlands dangerous to the navigator on the north coast of Russia, was called *Svjatoinos* (the holy cape), a name which for the oldest Russian Polar Sea navigators appears to have had the same signification as "the cape that can be passed with difficulty." No one however now thinks with any apprehension of the two "holy capes," which in former times limited the voyages of the Russians and Fins living on the White Sea to the east and west, and this, I am quite convinced, will some time be the case with this and all other holy capes in the Siberian Polar Sea.

The sea water in the sound was much mixed with river water and had a comparatively high temperature, even at a depth of nine to eleven metres. The animal life at the sea bottom was poor in species but rich in individuals, consisting principally of *Idothea entomon*, of which Dr. Stuxberg counted 800 specimens from a single sweep of the dredge. There were obtained at the same time, besides a few specimens of *Idothea Sabinei*, sponges and bryozoa in great abundance, and small mussels, crustacea, vermes, &c. Various fishes were also caught, and some small algæ collected. The trawl-net besides brought up from the bottom some fragments of mammoth tusks, and a large number of pieces of wood, for the most part sticks or branches, which appear to have stood upright in the clay, to judge from the fact that one of their ends was often covered with living bryozoa. These sticks often caused great inconvenience to the dredgers, by tearing the net that was being dragged along the bottom.

On the night preceding the 31st of August, as we steamed past Svjatoinos, a peculiar phenomenon was observed. The sky was clear in the zenith and in the east; in the west, on the other hand, there was a bluish-grey bank of cloud. The temperature of the water near the surface varied between + 1° and + 1°·6,

that of the air on the vessel between +1°·5 and +1°·8. Although thus both the air and the water had a temperature somewhat above the freezing-point, ice was seen to form on the calm, mirror-bright surface of the sea. This ice consisted partly of needles, partly of a thin sheet. I have previously on several occasions observed in the Arctic seas a similar phenomenon, that is to say, have observed the formation of ice when the temperature of the air was above the freezing-point. On this occasion, when the temperature of the uppermost stratum of water was also above the freezing-point, the formation of ice was clearly a sort of hoar-frost phenomenon, caused by radiation of heat, perhaps both upwards towards the atmosphere and downwards towards the bottom layer of water, cooled below the freezing-point.

The whole day we continued our voyage eastwards with glorious weather over a smooth ice-free sea, and in the same way on the 1st September, with a gentle southerly wind, the temperature of the air at noon in the shade being + 5°·6. On the night before the 2nd September the wind became northerly and the temperature of the air sank to − 1°. Little land was seen, though we were still not very far from the coast. Near to it there was a broad ice-free, or nearly ice-free, channel, but farther out to sea ice commenced. The following night snow fell, so that the whole of the deck and the Bear Islands, which we reached on the 3rd September, were sprinkled with it.

Hitherto, during the whole time we sailed *along the coast*, we had scarcely met with any fields of drift-ice but such as were formed of rotten, even, thin and scattered pieces of ice, in many places almost converted into ice-sludge, without an "ice-foot" and often dirty on the surface. No iceberg had been seen, nor any large glacier ice-blocks, such as on the coasts of Spitzbergen replace the Greenland icebergs. But east of Svjatoinos the ice began to increase in size and assume the same appearance as the ice north of Spitzbergen. It was here, besides, less dirty, and

rested on a hard ice-foot projecting deep under water and treacherous for the navigator.

The ice of the Polar Sea may be divided into the following varieties:—

1. *Icebergs.* The true icebergs have a height above the surface of the water rising to 100 metres. They often ground in a depth of 200 to 300 metres, and have thus sometimes a cross section of up to 400, perhaps 500 metres. Their area may amount to several square kilometres. Such enormous blocks of ice are projected into the North Polar Sea only from the glaciers of Greenland, and according to Payer's statement, from those of Franz-Josef Land also; but not, as some authors (GEIKIE, BROWN, and others) appear to assume and have shown by incorrect ideal drawings, from glaciers which project into the sea and there terminate with a perpendicular evenly-cut border, but from very uneven glaciers which always enter the sea in the bottoms of deep fjords, and are split up into icebergs long before they reach it. It is desirable that those who write on the origin of icebergs, should take into consideration the fact that icebergs are only formed at places where a violent motion takes place in the mass of the ice, which again within a comparatively short time results in the excavation of the deep ice-fjord. The largest iceberg, which, so far as I know, has been *measured* in that part of the Polar Sea which lies between Spitzbergen and Wrangel Land, is one which Barents saw at Cape Nassau on the $\frac{17}{7}$th August 1596. It was sixteen fathoms high, and had grounded in a depth of thirty-six fathoms. In the South Polar Sea icebergs occur in great numbers and of enormous size. If we may assume that they have an origin similar to those of Greenland, it is probable that round the South Pole there is an extensive continent indented by deep fjords.

2. *Glacier Ice-blocks.* These, which indeed have often been called icebergs, are distinguished from true icebergs not only by their size, but also by the way in which they are formed.

They have seldom a cross section of more than thirty or forty metres, and it is only exceptionally that they are more than ten metres high above the surface of the water. They originate from the "calving" of glaciers which project into the sea with a straight and evenly high precipitous border. Such glaciers occur in large numbers on the coasts of Spitzbergen, and they are there of the same height as similar evenly-cut glaciers on Greenland. According to the statement of the Dane PETERSEN, who took part both in KANE'S expedition in 1853-55 and in Torell's in 1861, the glaciers, for instance, at Hinloopen Strait in Spitzbergen, are fully equal, with respect to their size and the height of their borders above the sea-level, to the enormous and much bewritten Humboldt glacier in Greenland. In Spitzbergen too we find at two places miniatures of the Greenland ice-currents, for instance the glacier which filled the North Haven in Bell Sound, another glacier which filled an old Dutch whaling haven between Recherche Bay and Van Keulen Bay, a glacier on the north side of Wahlenberg Bay and perhaps at that part of the inland ice marked in my map of the expedition of 1872 as a bay on the east coast of North-east Land. It is even possible that small icebergs may be projected from the last-mentioned place, and thence drift out into the sea on the east coast of Spitzbergen.

Glacier-ice shows a great disposition to fall asunder into smaller pieces without any perceptible cause. It is full of cavities, containing compressed air, which, when the ice melts, bursts its attenuated envelope with a crackling sound like that of the electric spark. It thus behaves in this respect in the same way as some mineral salts which dissolve in water with slight explosions. Barents relates that on the $\frac{20}{10}$th August 1596 he anchored his vessel to a block of ice which was aground on the coast of Novaya Zemlya. Suddenly, and without any perceptible cause, the rock of ice burst asunder into hundreds of smaller pieces with a tremendous noise, and to the great terror of all the

men on board. Similar occurrences on a smaller scale I have myself witnessed. The cause to which they are due appears to me to be the following. The ice-block while part of the glacier is exposed to very severe pressure, which ceases when it falls into the sea. The pressure now in most cases equalises itself without any bursting asunder, but it sometimes happens that the inner strongly compressed portions of the ice-block cannot, although the pressure has ceased, expand freely in consequence of the continuous ice-envelope by which they are still surrounded. A powerful internal tension must thereby arise in the whole mass, which finally leads to its bursting into a thousand pieces. We have here a Prince Rupert's drop, but one whose diameter may rise to fifty metres, and which consists not of glass but of ice.

Glacier ice-blocks occur abundantly on the coasts of Spitzbergen and north Novaya Zemlya, but appear to be wanting or exceedingly rare along the whole north coast of Asia, between Yugor Schar and Wrangel Land. East of this they again occur, but not in any great numbers. This appears to show that the Western Siberian Polar Sea is not surrounded by any glacial lands. The glacier ice is commonly of a blue colour. When melted it yields a pure water, free of salt. Sometimes however it gives traces of salt, which are derived from the spray which the storms have carried high up on the surface of the glacier.

3. Pieces of ice from the ice-foot formed along the sea beach or the banks of rivers. They rise sometimes five or six metres above the surface of the water. They consist commonly of dirty ice, mixed with earth.

4. *River Ice,* level, comparatively small ice fields, which, when they reach the sea, are already so rotten that they soon melt away and disappear.

5. The walrus-hunters' *Bay Ice;* by which we understand level ice-fields formed in fjords and bays along the coast, and which

have there been exposed to a comparatively early summer heat. The bay ice therefore melts away completely during summer, and it is not commonly much pressed together. When all the snow upon it has disappeared, there is to be seen above the surface of the water a little ice of the same colour as the water, while under water very considerable portions of unmelted hard ice are still remaining. This has given rise to the walrus-hunters' statement, which has been warmly maintained, that the ice in autumn finally disappears by sinking. Nearly all the ice we met with in the course of our voyage belonged to this variety.

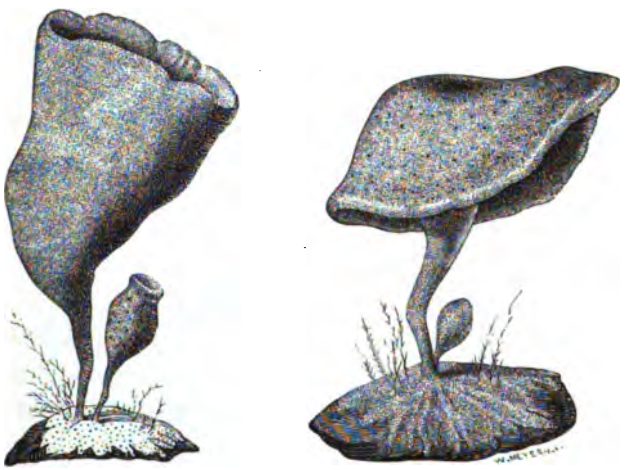
6. *Sea Ice*, or heavy ice, which often exhibits traces of having been much pressed together, but has not been exposed to any early summer heat. The walrus-hunters call it sea ice, wishing, I imagine, to indicate thereby that it is formed in the sea farther up towards the north. That it has drifted down from the north is indeed correct, but that it has been formed far from land over a considerable depth in the open sea is perhaps uncertain, as the ice that is formed there cannot, we think, be very thick. It has rather perhaps drifted down from the neighbourhood of some yet unknown Polar continent. Of this ice are formed most of the ice-fields in the seas east of Greenland, north of Spitzbergen, between Spitzbergen and the north island of Novaya Zemlya, and north of Behring's Straits. In the northern seas it does not melt completely during the summer, and remains of sea ice therefore often enter as component parts into the bay ice formed during the following winter. The latter then becomes rough and uneven, from remnants of old sea ice being frozen into the newly formed ice. Sea ice is often pressed together so as to form great *torosses* or ice-casts, formed of pieces of ice which at first are angular and piled loose on each other, but gradually become rounded, and freeze together into enormous blocks of ice, which, together with the glacier ice-blocks, form the principal mass

of the ground ice found on the coasts of the Polar lands. The water which is obtained by melting sea-ice is not completely free from salt, but the older it is the less salt does it contain.

East of the Bear Islands heavy sea-ice in pretty compact masses had drifted down towards the coast, but still left an open ice-free channel along the land. Here the higher animal world was exceedingly poor, which, as far as the avi-fauna was concerned, must be in some degree ascribed to the late season of the year. For Wrangel mentions a cliff at the Bear Islands which was covered with numberless birds' nests. He saw besides, on the largest of these islands, traces of the bear, wolf, fox, lemming, and reindeer (Wrangel's *Reise*, i. pp. 304 and 327). Now the surrounding sea was completely deserted. No Polar bear saluted us from the ice-floes, no walruses, and only very few seals were visible. During many watches not a single natatory bird was seen. Only the phalarope was still met with in large numbers, even pretty far out at sea. Perhaps it was then migrating from the north. The lower animal world was more abundant. From the surface of the sea the drag-net brought up various small surface crustacea, inconsiderable in themselves, but important as food for larger animals; and from the sea-bottom were obtained a large number of the same animal forms as from the sound at Svjatoinos, and in addition some beautiful asterids and a multitude of very large beaker sponges.

On the 3rd September, after we had sailed past the Bear Islands, the course was shaped right for Cape Chelagskoj. This course, as will be seen by a glance at the map, carried us far from the coast, and thus out of the channel next the land, in which we had hitherto sailed. The ice was heavy and close, although at first so distributed that it was navigable. But with a north wind, which began to blow on the night before the 1st September, the temperature fell below the freezing-point, and the water between the pieces of drift-ice was covered with a

very thick crust of ice, and the drift-ice came closer and closer together. It thus became impossible to continue the course which we had taken. We therefore turned towards the land, and at 6 o'clock P.M., after various bends in the ice and a few concussions against the pieces of ice that barred our way, again reached the ice-free channel, eight to twelve kilometres broad, next the land. While we lay a little way in among the drift-ice fields we could see no sign of open water, but it appeared as



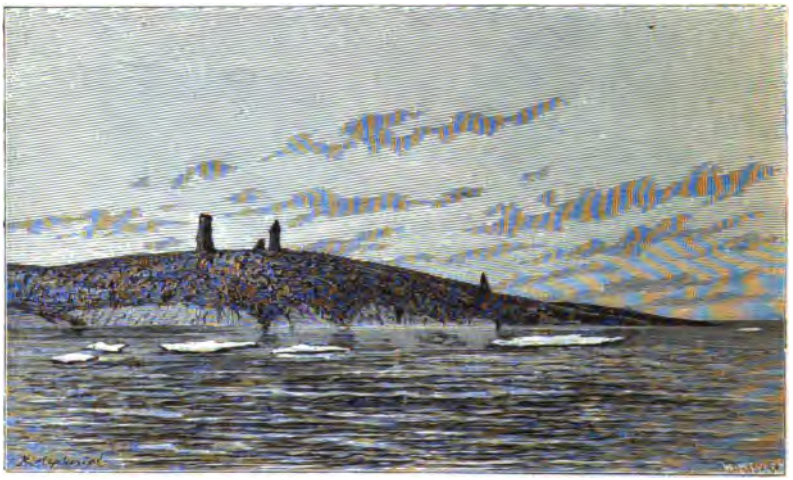
BEAKER SPONGES.

From the sea off the mouth of the Kolyma.

if the compact ice extended all the way to land, a circumstance which shows how careful the navigator ought to be in expressing an opinion as to the nature of the *pack* beyond the immediate neighbourhood of the vessel. The temperature of the air, which in the ice-field had sunk to — 3°, now rose at once to + 4°·1, while that of the water rose from — 1°·2 to + 3°·5, and its salinity fell from 2·4 to 1·3 per cent. All showed that we had now come into the current of the Kolyma, which from

causes which have been already stated, runs from the mouth of the river along the land in an easterly direction.

The Bear Islands lying off the mouth of the Kolyma are, for the most part, formed of a plutonic rock, whose upper part has weathered away, leaving gigantic isolated pillars. Four such pillars have given to the easternmost of the islands the name Lighthouse Island (Fyrpelarön). Similar ruin-like formations are found not only on Cape Baranov, which lies right



LIGHTHOUSE ISLAND.
After a drawing by O. Nordquist.

opposite, but also at a great number of other places in that portion of the north coast of Siberia which lies farther to the east. Generally these cliff-ruins are collected together over considerable areas in groups or regular rows. They have thus, when seen from the sea, so bewildering a resemblance to the ruins of a gigantic city which had once been surrounded by strong walls and been full of temples and splendid buildings, that one is almost tempted to see in them memorials of the

exploits of a Tamerlane or a Chingis Khan up here in the high north.

The north side of the hill-tops was powdered with new-fallen snow, but the rest of the land was clear of snow. The distance between the south point of Ljachoff's Island and the Bear Islands is 360′. This distance we had traversed in three days, having thus made 120′ in the twenty-four hours, or 5′ per hour. If we consider the time lost in dredging, sounding, and determining the temperature and salinity of the water, and the caution which the navigator must observe during a voyage in quite unknown waters, this speed shows that during this part of our voyage we were hindered by ice only to a slight extent. Cape Baranov was passed on the night before the 5th September, the mouth of Chaun Bay on the night before the 6th September, and Cape Chelagskoj was reached on the 6th at 4 o'clock P.M. The distance in a right line between this headland and the Bear Islands is 180′. In consequence of the many *détours* in the ice we had required 2½ days to traverse this distance, which corresponds to 72′ per day, or 3′ per hour, a speed which in a voyage in unknown, and for the most part ice-bestrewed waters, must yet be considered very satisfactory. But after this our progress began to be much slower. At midnight the sun was already 12° to 13° below the horizon, and the nights were now so dark that at that time of day we were compelled to lie still anchored to some large ground-ice. A further loss of time was caused by the dense fog which often prevailed by day, and which in the unknown shallow water next the land compelled Captain Palander to advance with extreme caution. The navigation along the north coast of Asia began to get somewhat monotonous. Even the most zealous Polar traveller may tire at last of mere ice, shallow water and fog; and mere fog, shallow water and ice.

Now, however, a pleasant change began, by our coming at last in contact with natives. In the whole stretch from Yugor Schar to Cape Chelagskoj we had seen neither men nor human

habitations, if I except the old uninhabited hut between Cape Chelyuskin and the Chatanga. But on the 6th September, when we were a little way off Cape Chelagskoj, two boats were sighted. Every man, with the exception of the cook, who could be induced by no catastrophe to leave his pots and pans, and who had circumnavigated Asia and Europe perhaps without having been once on land, rushed on deck. The boats were of skin, built in the same way as the "umiaks" or women's boats of the Eskimo. They were fully laden with laughing and

CHUKCH BOATS.

chattering natives, men, women, and children, who indicated by cries and gesticulations that they wished to come on board. The engine was stopped, the boats lay to, and a large number of skin-clad, bare-headed beings climbed up over the gunwale in a way that clearly indicated that they had seen vessels before. A lively talk began, but we soon became aware that none of the crew of the boats or the vessel knew any language common to both. It was an unfortunate circumstance, but signs were

employed as far as possible. This did not prevent the chatter from going on, and great gladness soon came to prevail, especially when some presents began to be distributed, mainly consisting of tobacco and Dutch clay pipes. It was remarkable that none of them could speak a single word of Russian, while a boy could count tolerably well up to ten in English, which shows that the natives here come into closer contact with American whalers than with Russian traders. They acknowledged the name *chukch* or *chautchu*.

Many of them were tall, well-grown men. They were clothed in close fitting skin trousers and "pesks" of reindeer skin. The head was bare, the hair always clipped short, with the exception of a small fringe in front, where the hair had a length of four centimetres and was combed down over the brow. Some had a cap of the sort used by the Russians at Chabarova, stuck into the belt behind, but they appeared to consider the weather still too warm for the use of this head-covering. The hair of most of them was bluish-black and exceedingly thick. The women were tattooed with black or bluish-black lines on the brow and nose, a number of similar lines on the chin, and finally some embellishments on the cheeks. The type of face did not strike one as so unpleasant as that of the Samoyeds or Eskimo. Some of the young girls were even not absolutely ugly. In comparison with the Samoyeds they were even rather cleanly, and had a beautiful, almost reddish-white complexion. Two of the men were quite fair. Probably they were descendants of Russians, who for some reason or other, as prisoners of war or fugitives, had come to live among the Chukches and had been nationalised by them.

In a little we continued our voyage, after the Chukches had returned to their boats, evidently well pleased with the gifts they had received and the leaf tobacco I had dealt out in bundles,—along with the clay pipes, of which every one got as many as he could carry between his fingers,—with the finery and

old clothes which my comrades and the crew strewed around them with generous hand. For we were all convinced that after some days we should come to waters where winter clothes would be altogether unnecessary, where our want of any article could easily be supplied at the nearest port, and where the means of

A CHUKCH IN SEAL-GUT GREAT COAT.
After a photograph by L. Palander.

exchange would not consist of goods, but of stamped pieces of metal and slips of paper.

On the 7th September, we steamed the whole day along the coast in pretty open ice. At night we lay to at a floe. The hempen tangles and the trawl-net were put out and yielded a very rich harvest. But in the morning we found ourselves

again so surrounded by ice and fog, that, after several unsuccessful attempts to make an immediate advance, we were compelled to lie-to at a large piece of drift-ice near the shore. When the fog had lightened so much that the vessel could be seen from the land, we were again visited by a large number of natives, whom as before we entertained as best we could. They invited us by evident signs to land and visit their tents. As it was in any case impossible immediately to continue our voyage, I accepted the invitation, ordered a boat to be put out, and landed along with most of my comrades.

The beach here is formed of a low bank of sand which runs between the sea and a small shallow lagoon or fresh-water lake, whose surface is nearly on a level with that of the sea. Farther into the interior the land rises gradually to bare hills, clear of snow or only covered with a thin coating of powdered snow from the fall of the last few days. Lagoon formations, with either fresh or salt water, of the same kind as those which we saw here for the first time, are distinctive of the north-eastern coast of Siberia. It is these formations which gave rise to the statement that on the north coast of Siberia it is difficult to settle the boundaries between sea and land. In winter this may be difficult enough, for the low bank which separates the lagoon from the sea is not easily distinguished when it has become covered with snow, and it may therefore readily happen in winter journeys along the coast that one is far into the land while he still believes himself to be out on the sea-ice. But when the snow has melted, the boundary is sharp enough, and the sea by no means shallow for such a distance as old accounts would indicate. A continual ice-mud-work also goes on here during the whole summer. Quite close to the beach accordingly the depth of water is two metres, and a kilometre farther out ten to eleven metres. Off the high rocky promontories the water is commonly navigable even for vessels of considerable draught close to the foot of the cliffs.

The villages of the Chukches commonly stand on the bank of sand which separates the lagoon from the sea. The dwellings consist of roomy skin tents, which enclose a sleeping chamber of the form of a parallelopiped surrounded by warm well-prepared reindeer skins, and lighted and warmed by one or more train-oil lamps. It is here that the family sleep during summer, and here most of them live day and night during winter. In summer, less frequently in winter, a fire is lighted besides in the

CHUKCH TENT.

(After a photograph by L. Palander.)

outer tent with wood, for which purpose a hole is opened in the top of the raised tent-roof. But to be compelled to use wood for heating the inner tent the Chukches consider the extremity of scarcity of fuel.

We were received everywhere in a very friendly way, and were offered whatever the house afforded. At the time the supply of food was abundant. In one tent reindeer beef was being boiled in a large cast-iron pot. At another two recently shot

or slaughtered reindeer were being cut in pieces. At a third an old woman was employed in taking out of the paunch of the reindeer the green spinage-like contents and cramming them into a sealskin bag, evidently to be preserved for green food during winter. The hand was used in this case as a scoop, and the naked arms were coloured high up with the certainly unappetising spinage, which however, according to the statements of Danish colonists in Greenland, has no unpleasant taste. Other skin sacks filled with train-oil stood in rows along the walls of the tent.

The Chukches offered train-oil for sale, and appeared to be surprised that we would not purchase any. In all the tents were found seals cut in pieces, a proof that the catch of seals had recently been abundant. At one tent lay two fresh walrus heads with large beautiful tusks. I tried without success to purchase these heads, but next day the tusks were offered to us. The Chukches appear to have a prejudice against disposing of the heads of slain animals. According to older travellers they even pay the walrus-head a sort of worship.

Children were met with in great numbers, healthy and thriving. In the inner tent the older children went nearly naked, and I saw them go out from it without shoes or other covering and run between the tents on the hoarfrost-covered ground. The younger were carried on the shoulders both of men and women, and were then so wrapped up that they resembled balls of skin. The children were treated with marked friendliness, and the older ones were never heard to utter an angry word. I purchased here a large number of household articles and dresses, which I shall describe further on.

On the morning of the 9th September we endeavoured to steam on, but were soon compelled by the dense fog to lie-to again at a ground-ice, which, when the fog lightened, was found to have stranded quite close to land. The depth here was eleven metres. At this place we lay till the morning of the

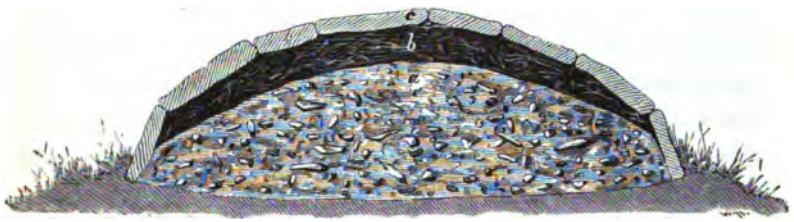
10th. The beach was formed of a sandbank,[1] which immediately above high-water mark was covered with a close grassy turf, a proof that the climate here, notwithstanding the neighbourhood of the pole of cold, is much more favourable to the development of vegetation than even the most favoured parts of the west coast of Spitzbergen. Farther inland was seen a very high, but snow-free, range of hills, and far beyond them some high snow-covered mountain summits. No glaciers were found here, though I consider it probable that small ones may be found in the valleys between the high fells in the interior. Nor were any erratic blocks found either in the interior of the coast country or along the strand bank. Thus it is probable that no such ice-covered land as Greenland for the present bounds the Siberian Polar Sea towards the north. At two places at the level of the sea in the neighbourhood of our anchorage the solid rock was bare. There it formed perpendicular shore cliffs, nine to twelve metres high, consisting of magnesian slate, limestone more or less mixed with quartz, and silicious slate. The strata were nearly perpendicular, ran from north to south, and did not contain any fossils. From a geological point of view therefore these rocks were of little interest. But they were abundantly covered with lichens, and yielded to Dr. Almquist important contributions to a knowledge of the previously quite unknown lichen flora of this region.

The harvest of the higher land plants on the other hand was, in consequence of the far advanced season of the year, incon-

[1] Of course the earth here at an inconsiderable depth under the surface is constantly frozen, but I have nowhere seen such alternating layers of earth and ice, crossed by veins of ice, as Hedenström in his oft-quoted work (*Otrywki o Sibiri*, p. 119) says he found at the sea-coast. Probably such a peculiar formation arises only at places where the spring floods bring down thick layers of mud, which cover the beds of ice formed during the winter and protect them for thousands of years from melting. I shall have an opportunity of returning to the interesting questions relating to this point.

siderable, if also of great scientific interest, as coming from a region never before visited by any botanist. In the sea Dr. Kjellman dredged without success for algæ. Of the higher animals we saw only a walrus and some few seals, but no land mammalia. Lemmings must however occasionally occur in incredible numbers, to judge by the holes and passages, excavated by these animals, by which the ground is crossed in all directions. Of birds the phalarope was still the most common species, especially at sea, where in flocks of six or seven it swam incessantly backwards and forwards between the pieces of ice.

No tents were met with in the neighbourhood of the vessel's anchorage, but at many places along the beach there were seen



SECTION OF A CHUKCH GRAVE.[1]
(After a drawing by A. Stuxberg.)
a. Layer of burned bones, much weathered. *b*. Layer of turf and twigs. *c*. Stones.

marks of old encampments, sooty rolled stones which had been used in the erection of the tents, broken household articles, and above all remains of the bones of the seal, reindeer, and walrus. At one place, a large number of walrus skulls lay in a ring, possibly remains from an entertainment following a large catch. Near the place where the tents had stood, at the mouth of a small

[1] Since we discovered the Chukches also bury their dead by laying them out on the *tundra*, we have begun to entertain doubts whether the collection of bones delineated here was actually a grave. Possibly these mounds were only the remains of fireplaces, where the Chukches had used as fuel train-drenched bones, and which they had afterwards for some reason or other endeavoured to protect from the action of the atmosphere.

stream not yet dried up or frozen, Dr. Stuxberg discovered some small mounds containing burnt bones. The cremation had been so complete that only one of the pieces of bone that were found could be determined by Dr. Almquist. It was a human tooth. After cremation the remains of the bones and the ash had been collected in an excavation, and covered first with turf and then with small flat stones. The encampments struck me as having been abandoned only a few years ago, and even the collections of bones did not appear to me to be old. But we ought to be very cautious when we endeavour in the Arctic regions to estimate the age of an old encampment, because in judging of the changes which the surface of the earth undergoes with time we are apt to be guided by our experience from more southerly regions. To how limited an extent this experience may be utilised in the high north is shown by RINK'S assertion that on Greenland at some of the huts of the Norwegian colonists, which have been deserted for centuries, footpaths can still be distinguished,[1] an observation to which I would scarcely give credence, until I had myself seen something similar at the site of a house in the bottom of Jacobshaven ice-fjord in north-western Greenland, which had been abandoned for one or two centuries. Here footpaths as sharply defined as if they had been trampled yesterday ran from the ruin in different directions. It may therefore very readily happen that the encampments in the neighbourhood of our present anchorage were older than we would be inclined at first sight to suppose. No refuse heaps of any importance were seen here.

This was the first time that any vessel had lain-to on this coast. Our arrival was therefore evidently considered by the natives a very remarkable occurrence, and the report of it appears to have spread very rapidly. For though there were no tents in the neighbourhood, we had many visitors. I still

[1] H. Rink, *Grönland geographisk og statistisk beskrevet*, Bd. 2, Copenhagen, 1857, p. 344.

availed myself of the opportunity of procuring by barter a large number of articles distinctive of the Chukches' mode of life. Eight years before I had collected and purchased a large number of ethnographical articles, and I was now surprised at the close correspondence there was between the household articles purchased from the Chukches, and those found in Greenland in old Eskimo graves.

My traffic with the natives was on this occasion attended with great difficulty. For I suffered from a sensible want of the first condition for the successful prosecution of a commercial undertaking, goods in demand. Because, during the expeditions of 1875 and 1876, I found myself unable to make use of the small wares I carried with me for barter with the natives, and found that Russian paper-money was readily taken. I had, at the departure of the *Vega* from Sweden, taken with me only money, not wares intended for barter. But money was of little use here. A twenty-five rouble note was less valued by the Chukches than a showy soap-box, and a gold or silver coin less than tin or brass buttons. I could, indeed, get rid of a few fifty-öre pieces, but only after I had first adapted them by boring to take the place of earrings.

The only proper wares for barter I now had were tobacco and Dutch clay pipes. Of tobacco I had only some dozen bundles, taken from a parcel which Mr. Sibiriakoff intended to import into Siberia by the Yenisej. Certain as I was of reaching the Pacific this autumn, I scattered my stock of tobacco around me with so liberal a hand that it was soon exhausted, and my Chukch friends' wants satisfied for several weeks. I therefore, as far as this currency was concerned, already when the *Vega* was beset, suffered the prodigal's fate of being soon left with an empty purse. Dutch clay pipes, again, I had in great abundance, from the accident that two boxes of these pipes, which were to have been imported into Siberia with the expedition of 1876, did not reach Trondhjem until the *Ymer* had sailed from that town.

They were instead taken on the *Vega*, and now, though quite too fragile for the hard fingers of Chukches, answered well for smaller bargains, as gifts of welcome to a large number of natives collected at the vessel, and as gifts to children in order to gain the favour of their parents. I besides distributed a large quantity of silver coin with King Oscar's effigy, in order, if any misfortune overtook us, to afford a means of ascertaining the places we had visited.

For the benefit of future travellers I may state that the wares most in demand are large sewing and darning needles, pots, knives (preferably large), axes, saws, boring tools and other iron tools, linen and woollen shirts (preferably of bright colours, but also white), neckerchiefs, tobacco and sugar. To these may be added the spirits which are in so great request among all savages; a currency of which, indeed, there was great abundance on the *Vega*, but which I considered myself prevented from making use of. In exchange for this it is possible to obtain, in short, anything whatever from many of the natives, but by no means from all, for even here there are men who will not taste spirits, but with a gesture of disdain refuse the glass that is offered them. The Chukches are otherwise shrewd and calculating men of business, accustomed to study their own advantage. They have been brought up to this from childhood through the barter which they carry on between America and Siberia. Many a beaver-skin that comes to the market at Irbit belongs to an animal that has been caught in America, whose skin has passed from hand to hand among the wild men of America and Siberia, until it finally reaches the Russian merchant. For this barter a sort of market is held on an island in Behring's Straits. At the most remote markets in Polar America, a beaver-skin is said some years ago to have been occasionally exchanged for a leaf of tobacco.[1] An exceedingly beautiful black fox-skin was

[1] C. von Dittmar, *Bulletin hist.-philolog. de l'Acad. de St. Pétersbourg*, XIII. 1856, p. 130.

offered to me by a Chukch for a pot. Unfortunately I had none that I could dispense with. Here, too, prices have risen. When the Russians first came to Kamchatka, they got eight sable-skins for a knife, and eighteen for an axe, and yet the Kamchadales laughed at the credulous foreigners who were so easily deceived. At Yakutsk, when the Russians first settled there, a pot was even sold for as many sable-skins as it could hold.[1]

During the night before the 10th September, the surface of the sea was covered with a very thick sheet of newly-frozen ice, which was broken up again in the neighbourhood of the vessel by blocks of old ice drifting about. The *pack* itself appeared to have scattered a little. We therefore weighed anchor to continue our voyage. At first a *détour* towards the west was necessary to get round a field of drift-ice. Here too, however, our way was barred by a belt of old ice, which was bound together so firmly by the ice that had been formed in the course of the night, that a couple of hours' work with axes and ice-hatchets was required to open a channel through it. On the other side of this belt of ice we came again into pretty open water, but the fog, instead, became so dense that we had again to lie-to at a ground-ice, lying farther out to the sea but more to the west than our former resting-place. On the night before the 11th there was a violent motion among the ice. Fortunately the air cleared in the morning, so that we could hold on our course among pretty open ice, until on the approach of night we were obliged as usual to lie-to at a ground-ice.

The following day, the 12th September, when we had passed Irkaipij, or Cape North, a good way, we fell in with so close ice that there was no possibility of penetrating farther. We were therefore compelled to return, and were able to make our way with great difficulty among the closely packed masses of drift

[1] Krascheninnikov, *Histoire et Description du Kamtschatka*, Amsterdam 1770, II. p. 95. A. Erman, *Reise um die Erde*, D. 1, B. 2, p. 255.

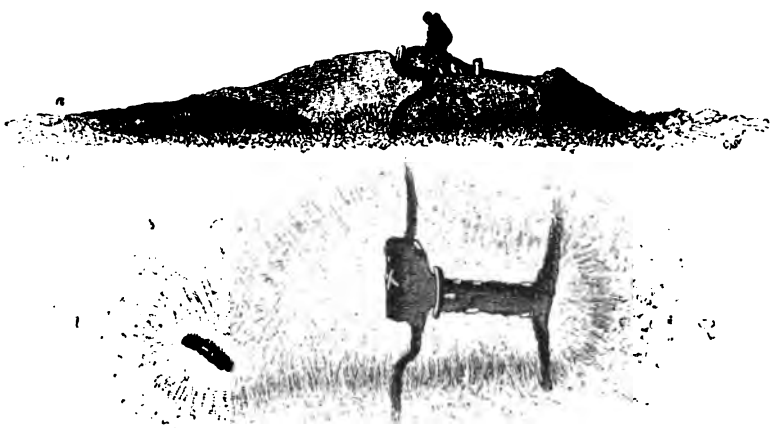
ice. Here the vessel was anchored in the lee of a ground-ice, which had stranded near the northernmost spur of Irkaipij, until a strong tidal current began to carry large pieces of drift-ice past the vessel's anchorage. She was now removed and anchored anew in a little bay open to the north, which was formed by two rocky points jutting out from the mainland. Unfortunately we were detained here, waiting for a better state of the ice, until the 18th September. It was this involuntary

IRKAIPIJ.
(After a drawing by O. Nordquist.)

delay which must be considered the main cause of our wintering.

Irkaipij is the northernmost promontory in that part of Asia, which was seen by Cook in 1778. It was, therefore, called by him Cape North, a name which has since been adopted in most maps, although it is apt to lead to confusion from capes similarly named being found in most countries. It is also incorrect,

because the cape does not form the northernmost promontory either of the whole of Siberia, or of any considerable portion of it. For the northernmost point of the mainland of Siberia is Cape Chelyuskin, the northernmost in the land east of the Lena Svjatoinos, the northernmost in the stretch of coast east of Chaun Bay, Cape Chelagskoj, and so on. Cape North ought, therefore, to be replaced by the original name Irkaipij, which is well known to all the natives between Chaun Bay and Behring's Straits.



REMAINS OF AN ONKILON HOUSE.
a. Seen from the side. *b*. From above.
(After a drawing by O. Nordquist.)

On the neck of land which connects Irkaipij with the mainland, there was at the time of our visit a village consisting of sixteen tents. We saw here also *ruins*, viz. the remains of a large number of old house-sites, which belonged to a race called *Onkilon*,[1] who formerly inhabited these regions, and some centuries ago were

[1] *Ankali* signifies in Chukch dwellers on the coast, and is now used to denote the Chukches living on the coast. A similar word, Onkilon, was formerly used as the name of the Eskimo tribe that lived on the coast of the Polar Sea when the Chukch migration reached that point.

driven by the Chukches, according to tradition, to some remote islands in the Polar Sea. At these old house-sites Dr. Almquist and Lieutenant Nordquist set on foot excavations in order to collect contributions to the ethnography of this traditional race. The houses appear to have been built, at least partly, of the

IMPLEMENTS FOUND IN THE RUINS OF AN ONKILON HOUSE.

1. Stone chisel with bone handle, one-half the natural size. 2, 4. Knives of slate, one-third. 3, 7. Spear-heads of slate, one-third. 5. Spear-head of bone, one-third. 6. Bone spoon, one-third.

bones of the whale, and half sunk in the earth. The refuse heaps in the neighbourhood contained bones of several species of the whale, among them the white whale, and of the seal, walrus, reindeer, bear, dog, fox, and various kinds of birds. Besides these remains of the produce of the chase, there were

found implements of stone and bone, among which were stone axes, which, after lying 250 years in the earth, were still fixed to their handles of wood or bone. Even the thongs with which the axe had been bound fast to, or *wedged into*, the handle, were still remaining. The tusks of the walrus[1] had to the former inhabitants of the place, as to the Chukches of the present, yielded a material which in many cases may be used with greater advantage than flint for spear-heads, bird-arrows, fish-hooks, ice-axes, &c. Walrus tusks, more or less worked, accordingly were found in the excavations in great abundance. The bones of the whale had also been employed on a great scale, but we did not find any large pieces of mammoth tusks, an indication that the race was not in any intimate contact with the inhabitants of the regions to the westward, so rich in the remains of the mammoth.[2] At many places the old Onkilon houses were used by the Chukches as stores for blubber; and at others, excavations had been made in the refuse heaps in search of walrus tusks. Our researches were regarded by the Chukches with mistrust. An old man who came, as it were by chance, from the interior of the country past the place where we worked, remained there a while, regarding our labours with apparent indifference, until he convinced himself that from simplicity, or

[1] The walrus now appears to be very rare in the sea north of Behring's Straits, but formerly it must have been found there in large numbers, and made that region a veritable paradise for every hunting tribe. While we during our long stay there saw only a few walruses, Cook, in 1778, saw an enormous number, and an interesting drawing of walruses is to be found in the account of his third voyage. *A Voyage to the Pacific Ocean, etc.*, Vol. III. (by James King), London, 1784, p. 259, pl. 52.

[2] The greatest number of mammoth tusks is obtained from the stretches of land and the islands between the Chatanga and Chaun Bay. Here the walrus is wanting. The inhabitants of North Siberia therefore praise the wisdom of the Creator, who lets the walrus live in the regions where the mammoth is wanting, and has scattered mammoth ivory in the earthy layers of the coasts where the walrus does not occur (A. Erman, *Reise um die Erde*, Berlin, 1833—48, D. 1, B. 2, p. 264).

some other reason unintelligible to him, we avoided touching the blubber-stores, but instead rooted up in search of old fragments of bone or stone-flakes.

Remains of old dwellings were found even at the highest points among the stone mounds of Irkaipij, and here perhaps was the last asylum of the Onkilon race. At many places on the mountain slopes were seen large collections of bones, consisting partly of a large number (at one place up to fifty) of bears' skulls overgrown with lichens, laid in circles, with the nose inwards, partly of the skulls of the reindeer, Polar bear,[1] and walrus, mixed together in a less regular circle, in the midst of which reindeer horns were found set up. Along with the reindeer horns there was found the coronal bone of an elk with portions of the horns still attached. Beside the other bones lay innumerable temple-bones of the seal, for the most part fresh and not lichen-covered. Other seal bones were almost completely absent, which shows that temple-bones were not remains of weathered seal skulls, but had been gathered to the place for one reason or another in recent times. No portions of human skeletons were found in the neighbourhood. These places are sacrificial places, which the one race has inherited from the other.

WRANGEL gives the following account of the tribe which lived here in former times:—

"As is well known the sea-coast at Anadyr Bay is inhabited by a race of men, who, by their bodily formation, dress, language, differ manifestly from the Chukches, and call themselves Onkilon-seafolk. In the account of Captain BILLING'S journey through the country of the Chukches, he shows the near relationship the language of this coast tribe has to that of the Aleutians at Kadyak, who are of the same primitive stem as the Greenlanders. Tradition

[1] Among the bears' skulls brought home from this place Lieut. Nordquist found after his return home the skull of a sea-lion (*Otaria Stelleri*). It is, however, uncertain whether the animal was captured in the region, or whether the cranium was brought hither from Kamchatka.

relates that upwards of two hundred years ago these Onkilon occupied the whole of the Chukch coast, from Cape Chelagskoj to Behring's Straits, and indeed we still find along the whole of this stretch remains of their earth huts, which must have been very unlike the present dwellings of the Chukches; they have the form of small mounds, are half sunk in the ground and closed above with whale ribs, which are covered with a thick layer of earth. A violent quarrel between Krächoj, the chief of these North-Asiatic Eskimo, and an *errim* or chief of the reindeer Chukches, broke out into open feud. Krächoj drew the shorter straw, and found himself compelled to fly, and leave the country with his people; since then the whole coast has been desolate and uninhabited. Of the emigration of these Onkilon, the inhabitants of the village Irkaipij, where Krächoj appears to have lived, narrated the following story. He had killed a Chukch *errim*, and was therefore eagerly pursued by the son of the murdered man, whose pursuit he for a considerable time escaped. Finally Krächoj believed that he had found a secure asylum on the rock at Irkaipij, where he fortified himself behind a sort of natural wall, which can still be seen. But the young Chukch *errim*, driven by desire to avenge his father's death, finds means to make his way within the fortification and kills Krächoj's son. Although the blood-revenge was now probably complete according to the prevailing ideas, Krächoj must have feared a further pursuit by his unrelenting enemy, for during night he lowers himself with thongs from his lofty asylum, nearly overhanging the sea, enters a boat, which waits for him at the foot of the cliff, and, in order to lead his pursuers astray, steers first towards the east, but at nightfall turns to the west, reaches Schalaurov Island, and there fortifies himself in an earth hut, whose remains we (Wrangel's expedition) have still seen. Here he then collected all the members of his tribe, and fled with them in 15 "baydars" to the land whose mountains the Chukches assure themselves they can in clear sunshine see from Cape Yakan. During the following winter a Chukch related to Krächoj disappeared in addition with his family and reindeer, and it is supposed that he too betook himself to the land beyond the sea. With this another tradition agrees, which was communicated to us by the inhabitants of Kolyutschin Island. For an old man informed me (Wrangel) that during his grandfather's lifetime a "baydar" with seven Chukches, among them a woman, had ventured too far out to sea. After they had long been driven hither and thither by the wind, they stranded on a country unknown to them, whose inhabitants struck the Chukches themselves as

coarse and brutish. The shipwrecked men were all murdered. Only the woman was saved, was very well treated, and taken round the whole country, and shown to the natives as something rare and remarkable. So she came at last to the Kargauts, a race living on the American coast at Behring's Straits, whence she found means to escape to her own tribe. This woman told her countrymen much about her travels and adventures; among other things she said that she had been in a great land which lay north of Kolyutschin Island, stretched far to the *west*, and was probably connected with America. This land was inhabited by several races of men; those living in the west resembled the Chukches in every respect, but those living in the east were so wild and brutish, that they scarcely deserved to be called men. The whole account, both of the woman herself and of the narrators of the tradition, is mixed up with so many improbable adventures, that it would scarcely be deserving of any attention were it not remarkable for its correspondence with the history of Krächoj."[1]

When Wrangel wrote that, he did not believe in the existence of the land which is to be found set out on his map in 177° E.L. and 71° N.L., and which, afterwards discovered by the Englishman KELLET, according to the saying, *lucus a non lucendo*, obtained the name of Wrangel Land. Now we know that the land spoken of by tradition actually exists, and therefore there is much that even tells in favour of its extending as far as to the archipelago on the north coast of America.

With this fresh light thrown upon it, the old Chukch woman's story ought to furnish a valuable hint for future exploratory voyages in the sea north of Behring's Straits, and an important contribution towards forming a judgment of the fate which has befallen the American *Jeannette* expedition, of which, while this is being written, accounts are still wanting.[2]

[1] Wrangel's *Reise*, Th. 2, Berlin, 1839, p. 220.

[2] According to a paper in *Deutsche Geografische Blätter*, B. IV. p. 54, Captain E. Dallmann, in 1866, as commander of the Havai schooner *W. C. Talbot*, not only saw but landed on Wrangel Land. As Captain Dallmann of recent years has been in pretty close contact with a large number of geographers, and communications from him have been previously inserted

Between us and the inhabitants of the present Chukch village at Irkaipij there soon arose very friendly relations. A somewhat stout, well-grown, tall and handsome man named Chepurin, we took at first to be chief. He was therefore repeatedly entertained in the gunroom, on which occasions small gifts were given him to secure his friendship. Chepurin had clearly a weakness for gentility and grandeur, and could now, by means of the barter he carried on with us and the presents he received, gratify his love of show to a degree of which he probably had never before dreamed. When during the last days of our stay he paid a visit to the *Vega* he was clad in a red woollen shirt drawn over his "pesk," and from either ear hung a gilt watch-chain, to the lower end of which a perforated ten-öre piece was fastened. Already on our arrival he was better clothed than the others, his tent was larger and provided with two sleeping apartments, one for each of his wives. But notwithstanding all this we soon found that we had made a mistake, when, thinking that a society could not exist without government, we assigned to him so exalted a position. Here, as in all Chukch villages which we afterwards visited, absolute anarchy prevailed.

At the same time the greatest unanimity reigned in the little headless community. Children, healthy and thriving, tenderly cared for by the inhabitants, were found in large numbers. A good word to them was sufficient to pave the way for a friendly reception in the tent. The women were treated as the equals of the men, and the wife was always consulted by the husband when a more important bargain than usual was to be made; many times it was carried through only after the giver of advice had been bribed with a neckerchief or a variegated handkerchief. The

in geographical journals, it appears strange that he has now for the first time made public this important voyage. At all events, Dallmann's statement that the musk-ox occurs on the coast of the Polar Sea and on Wrangel Land is erroneous. He has here confused the musk-ox with the reindeer.

articles which the man purchased were immediately committed to the wife's keeping. One of the children had round his neck a band of pearls with a Chinese coin having a square hole in the middle, suspended from it; another bore a perforated American cent piece. None knew a word of Russian, but here too a youngster could count ten in English. They also knew the word "ship." In all the tents, reindeer stomachs were seen with their contents, or sacks stuffed full of other green herbs. Several times we were offered in return for the bits of sugar and pieces of tobacco which we distributed, wrinkled root-bulbs somewhat larger than a hazel nut, which had an exceedingly pleasant taste, resembling that of fresh nuts. A seal caught in a net among the ice during our visit was cut up in the tent by the women. On this occasion they were surrounded by a large number of children, who were now and then treated to bloody strips of flesh. The youngsters carried on the work of cutting up *con amore*, coquetting a little with their bloody arms and faces.

The rock which prevails in this region consists mainly of gabbro, which in the interior forms several isolated, black, plateau-formed hills, 100 to 150 metres high, between which an even, grassy, but treeless plain extends. It probably rests on sedimentary strata. For on the western side of Irkaipij the plutonic rock is seen to rest on a black slate with traces of fossils, for the most part obscure vegetable impressions, probably belonging to the Permian Carboniferous formation.

Uneasy at the protracted delay here I made an excursion to a hill in the neighbourhood of our anchorage, which, according to a barometrical measurement, was 129 metres high, in order, from a considerable height, to get a better view of the ice than was possible by a boat reconnaisance. The hill was called by the Chukches Hammong-Ommang. From it we had an extensive view of the sea. It was everywhere covered with closely packed drift-ice. Only next the land was seen an open channel, which, however, was interrupted in an ominous way by belts of ice.

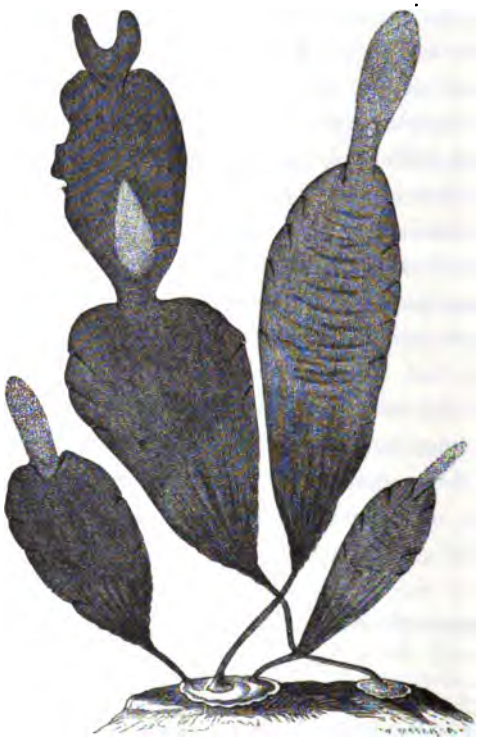
The plutonic rock, of which the hill was formed, was almost everywhere broken up by the action of the frost into angular blocks of stone, so that its surface was converted into an enormous stone mound. The stones were on the wind side covered with a translucent glassy ice-crust, which readily fell away, and added considerably to the difficulty of the ascent. I had previously observed the formation of such an ice-crust on the northernmost mountain summits of Spitzbergen.[1] It arises undoubtedly from the fall of super-cooled mist, that is to say of mist whose vesicles have been cooled considerably below the freezing-point without being changed to ice, which first takes place when, after falling, they come in contact with ice or snow, or some angular hard object. It is such a mist that causes the icing down of the rigging of vessels, a very unpleasant phenomenon for the navigator, which we experienced during the following days, when the tackling of the *Vega* was covered with pieces of ice so large, and layers so thick, that accidents might have happened by the falling of the ice on the deck.[2]

The dredgings here yielded to Dr. Kjellman some algæ, and to Dr. Stuxberg masses of a species of cumacea, *Diastylis Rathkei* Kr., of *Acanthostephia Malmgreni* Goës, and *Liparis gelatinosus* Pallas, but little else. On the steep slopes of the

[1] Cf. *Redogörelse för den svenska polarexpeditionen år 1872-73* (Bihang till Vet. Ak. handl. Bd. 2, No. 18, p. 91).

[2] A more dangerous kind of icing down threatens the navigator in severe weather not only in the Polar Seas but also in the Baltic and the North Sea. For it happens at that season that the sea-water at the surface is overcooled, that is, cooled below the freezing-point without being frozen. Every wave which strikes the vessel is then converted by the concussion into ice-sludge, which increases and freezes together to hard ice so speedily that all attempts to remove it from the deck are in vain. In a few hours the vessel may be changed into an unmanageable floating block of ice which the sailors, exhausted by hard labour, must in despair abandon to its fate. Such an icing down, though with a fortunate issue, befell the steamer *Sofia* in the month of October off Bear Island, during the Swedish Polar Expedition of 1868.

north side of Irkaipij a species of cormorant had settled in so large numbers that the cliff there might be called a true fowl-fell. A large number of seals were visible among the ice, and along with the cormorant a few other birds, principally phalaropes. Fish were now seen only in exceedingly small numbers.



ALGA FROM IRKAIPIJ.
Laminaria solidungula (J. G. Ag.).

Even in the summer, fishing here does not appear to be specially abundant, to judge from the fact that the Chukches had not collected any stock for the winter. We were offered, however, a salmon or two of small size.

On the 18th September[1] the state of the ice was quite unchanged. If a wintering was to be avoided, it was, however, not advisable to remain longer here. It had besides appeared from the hill-top which I visited the day before that an open

CORMORANT FROM IRKAIPIJ.
Graculus bicristatus (Pallas).

water channel, only interrupted at two places by ice, was still to be found along the coast. The anchor accordingly was weighed,

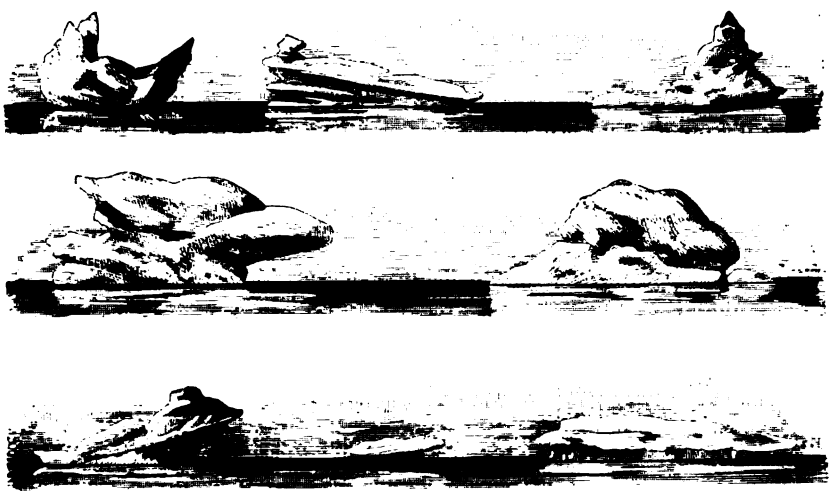
[1] Irkaipij lies in 180° long. from Greenwich. To bring our day-reckoning into agreement with that of the New World, we ought thus to have here lessened our date by one day, and have written the 17th for the 18th September. But as, with the exception of the short excursion to Port Clarence and St. Edward Island, we always followed the coasts of the Old World, and during our stay in the new hemisphere did not visit any place inhabited by Europeans, we retained during the whole of our voyage our European day-reckoning unaltered. If we had met with an American whaler, we would have been before him one day, our 27th September would thus have corresponded to his 26th. The same would have been the case on our coming to an American port.

and the *Vega* steamed on, but in a depth of only 6 to 8 metres. As the *Vega's* draught is from 4·8 to 5 metres, we had only a little water under the keel, and that among ice in quite unknown waters. About twenty kilometres from the anchorage, we met with a belt of ice through which we could make our way though only with great difficulty, thanks to the *Vega's* strong bow enabling her to withstand the violent concussions. Our voyage was then continued, often in yet shallower water than before, until the vessel, at 8 o'clock in the morning, struck on a ground ice foot. The tide was falling, and on that account it was not until next morning that we could get off, after a considerable portion of the ground-ice, on whose foot the *Vega* had run up, had been hewn away with axes and ice-hatchets. Some attempts were made to blast the ice with gunpowder, but they were unsuccessful. For this purpose dynamite is much more efficacious, and this explosive ought therefore always to form part of the equipment in voyages in which belts of ice have to be broken through.

On the 19th we continued our voyage in the same way as before, in still and for the most part shallow water near the coast, between high masses of ground-ice, which frequently had the most picturesque forms. Later in the day we again fell in with very low ice formed in rivers and shut-in inlets of the sea, and came into slightly salt water having a temperature above the freezing-point.

After having been moored during the night to a large ground-ice, the *Vega* continued her course on the 20th September almost exclusively among low, dirty ice, which had not been much pressed together during the preceding winter. This ice was not so deep in the water as the blue ground-ice, and could therefore drift nearer the coast, a great inconvenience for our vessel, which drew so much water. We soon came to a place where the ice was packed so close to land that an open channel only $3\frac{1}{2}$ to $4\frac{1}{2}$ metres deep remained close to the shore. We

were therefore compelled after some hours' sailing to lie-to at a ground-ice to await more favourable circumstances. The wind had now gone from west to north and north-west. Notwithstanding this the temperature became milder and the weather rainy, a sign that great open stretches of water lay to the north and north-west of us. During the night before the 21st it rained heavily, the wind being N.N.W. and the temperature + 2°. An attempt was made on that day to find some place where



PIECES OF ICE FROM THE COAST OF THE CHUKCH PENINSULA.
(After a drawing by O. Nordquist.)

the belt of drift-ice that was pressed against the land could be broken through, but it was unsuccessful, probably in consequence of the exceedingly dense fog which prevailed.

Dredging gave but a scanty yield here, probably because the animal life in water so shallow as that in which we were anchored, is destroyed by the ground-ices, which drift about here for the greater part of the year. Excursions to the neighbouring coast on the other hand, notwithstanding the late season

of the year, afforded to the botanists of the *Vega* valuable information regarding the flora of the region.

On the 22nd I made, along with Captain Palander, an excursion in the steam launch to take soundings farther to the east. We soon succeeded in discovering a channel of sufficient depth and not too much blocked with ice, and on the 23rd the *Vega* was able to resume her voyage among very closely packed drift-ice, often so near the land that she had only a fourth of a metre of water under her keel. We went forward however, if slowly.

The land here formed a grassy plain, still clear of snow, rising inland to gently sloping hills or earthy heights. The beach was strewn with a not inconsiderable quantity of driftwood, and here and there were seen the remains of old dwelling-places. On the evening of the 23rd September we lay-to at a ground-ice in a pretty large opening of the ice-field. This opening closed in the course of the night, so that on the 24th and 25th we could make only very little progress, but on the 26th we continued our course, at first with difficulty, but afterwards in pretty open water to the headland which on the maps is called Cape Onman. The natives too, who came on board here, gave the place that name. The ice we met with on that day was heavier than before, and bluish-white, not dirty. It was accordingly formed farther out at sea.

On the 27th we continued our course in somewhat open water to Kolyutschin Bay. No large river debouches in the bottom of this great fjord, the only one on the north coast of Asia which, by its long narrow form, the configuration of the neighbouring shores, and its division into two at the bottom, reminds us of the Spitzbergen fjords which have been excavated by glaciers. The mouth of the bay was filled with very closely packed drift-ice that had gathered round the island situated there, which was inhabited by a large number of Chukch families. In order to avoid this ice the *Vega* made a considerable *détour* up the fjord. The weather was calm and fine, but new ice was formed every-

where among the old drift-ice where it was closely packed. Small seals swarmed by hundreds among the ice, following the wake of the vessel with curiosity. Birds on the contrary were seen in limited numbers. Most of them had evidently already migrated to more southerly seas. At 4.45 P.M. the vessel was anchored to an ice-floe near the eastern shore of the fjord. It could be seen from this point that the ice at the headland, which bounded the mouth of the fjord to the east, lay so near land that there was a risk that the open water next the shore would not be deep enough for the *Vega*.

Lieutenant Hovgaard was therefore sent with the steam launch to take soundings. He returned with the report that the water off the headland was sufficiently deep. At the same time, accompanied by several of the naturalists, I made an excursion on land. In the course of this excursion the hunter Johnsen was sent to the top of the range of heights which occupied the interior of the promontory, in order to get a view of the state of the ice farther to the east. Johnsen too returned with the very comforting news that a very broad open channel extended beyond the headland along the coast to the south-east. I was wandering about along with my comrades on the slopes near the beach in order, so far as the falling darkness permitted, to examine its natural conditions, when Johnsen came down; he informed us that from the top of the height one could hear bustle and noise and see fires at an encampment on the other side of the headland. He supposed that the natives were celebrating some festival. I had a strong inclination to go thither in order, as I thought, "to take farewell of the Chukches," for I was quite certain that on some of the following days we should sail into the Pacific. But it was already late in the evening and dark, and we were not yet sufficiently acquainted with the disposition of the Chukches to go by night, without any serious occasion, in small numbers and provided only with the weapons of the chase, to an encampment with which we

were not acquainted. It was not until afterwards that we learned that such a visit was not attended with any danger. Instead of going to the encampment, as the vessel in any case could not weigh anchor this evening, we remained some hours longer on the beach and lighted there an immense log fire of drift-wood, round which we were soon all collected, chatting merrily about the remaining part of the voyage in seas where not cold but heat would trouble us, and where our progress at least would not be obstructed by ice, continual fog, and unknown shallows. None of us then had any idea that, instead of the heat of the tropics, we would for the next ten months be experiencing a winter at the pole of cold, frozen in on an unprotected road, under almost continual snow-storms, and with a temperature which often sank below the freezing-point of mercury.

The evening was glorious, the sky clear, and the air so calm that the flames and smoke of the log fire rose high against the sky. The dark surface of the water, covered as it was with a thin film of ice, reflected its light as a fire-way straight as a line, bounded far away at the horizon by a belt of ice, whose inequalities appeared in the darkness as the summits of a distant high mountain chain. The temperature in the quite draught-free air was felt to be mild, and the thermometer showed only 2° under the freezing-point. This slight degree of cold was however sufficient to cover the sea in the course of the night with a sheet of newly-frozen ice, which, as the following days' experience showed, at the opener places could indeed only delay, not obstruct the advance of the *Vega*, but which however bound together the fields of drift-ice collected off the coast so firmly that a vessel, even with the help of steam, could with difficulty force her way through.

When on the following day, the 28th September, we had sailed past the headland which bounds Kolyutschin Bay on the east, the channel next the coast, clear of drift-ice, but covered

with newly formed ice, became suddenly shallow. The depth was too small for the *Vega*, for which we had now to seek a course among the blocks of ground-ice and fields of drift-ice in the offing. The night's frost had bound these so firmly together that the attempt failed. We were thus compelled to lie-to at a ground-ice so much the more certain of getting off with the first shift of the wind, and of being able to traverse the few miles that separated us from the open water at Behring's Straits, as whalers on several occasions had not left this region until the middle of October.

As American whalers had during the last decades extended their whale-fishing to the North Behring Sea, I applied before my departure from home both directly and through the Foreign Office to several American scientific men and authorities with a request for information as to the state of the ice in that sea. In all quarters my request was received with special good-will and best wishes for the projected journey. I thus obtained both a large quantity of printed matter otherwise difficult of access, and maps of the sea between North America and North Asia, and oral and written communications from several persons: among whom may be mentioned the distinguished naturalist, Prof. W. H. DALL of Washington, who lived for a long time in the Territory of Alaska and the north part of the Pacific; Admiral JOHN RODGERS, who was commander of the American man-of-war, *Vincennes*, when cruising north of Behring's Straits in 1855; and WASHBURN MAYNOD, lieutenant in the American Navy. I had besides obtained important information from the German sea-captain E. DALLMANN, who for several years commanded a vessel in these waters for coast traffic with the natives. Space does not permit me to insert all these writings here. But to show that there were good grounds for not considering the season of navigation in the sea between Kolyutschin Bay and Behring's Straits closed at the end of September, I shall make some extracts from a letter sent to me, through the American Consul-

General in Stockholm, N. A. ELVING, from Mr. MILLER, the president of the Alaska Commercial Company.

"The following is an epitome of the information we have received regarding the subject of your inquiry.

"The bark *Massachusetts*, Captain O. WILLIAMS, was in 74° 30′ N.L. and 173° W.L. on the 21st Sept. 1867. No ice in sight in the north, but to the east saw ice. Saw high peaks bearing W.N.W. about 60′. Captain Williams is of opinion that Plover Island, so-called by Kellet, is a headland of Wrangel Land. Captain Williams says that he is of opinion from his observations, that usually after the middle of August there is no ice south of 70°—west of 175°, until the 1st of October. There is hardly a year but that you could go as far as Cape North (Irkaipij), which is 180°, during the month of September. If the winds through July and August have prevailed from the S.W., as is usual, the north shore will be found clear of ice. The season of 1877 was regarded as an 'icy season,' a good deal of ice to southward. 1876 was an open season; as was 1875. Our captain, GUSTAV NIEBAUM, states that the east side of Behring's Straits is open till November; he passed through the Straits as late as October 22nd two different seasons. The north shore was clear of all danger within reasonable distance. In 1869 the bark *Navy* anchored under Kolyutschin Island from the 8th to the 10th October. On the 10th October of that year there was no ice south and east of Wrangel Land."

These accounts show that I indeed might have reason to be uneasy at my ill luck in again losing some days at a place at whose bare coast, exposed to the winds of the Polar Sea, there was little of scientific interest to employ ourselves with, little at least in comparison with what one could do in a few days, for instance, at the islands in Behring's Straits or in St. Lawrence Bay, lying as it does south of the easternmost promontory of Asia and therefore sheltered from the winds of the Arctic Ocean, but that there were no grounds for fearing that it would be necessary to winter there. I also thought that I could come to the same conclusion from the experience gained in my wintering on Spitzbergen in 1872-73, when permanent ice was first formed in our haven, in the 80th degree of latitude, during the month of

February. Now, however, the case was quite different. The fragile ice-sheet, which on the 28th September bound together the ground-ices and hindered our progress, increased daily in strength under the influence of severer and severer cold until it was melted by the summer heat of the following year. Long after we were beset, however, there was still open water on the coast four or five kilometres from our winter haven, and after our return home I was informed that, on the day on which we were frozen in, an American whaler was anchored at that place.

Whether our sailing along the north coast of Asia to Kolyutschin Bay was a fortunate accident or not, the future will show. I for my part believe that it was a fortunate accident, which will often happen. Certain it is, in any case, that when we had come so far as to this point, our being frozen in was a quite accidental misfortune brought about by an unusual state of the ice in the autumn of 1878 in the North Behring Sea.

CHAPTER X.

Wintering becomes necessary—The position of the *Vega*—The ice round the vessel—American ship in the neighbourhood of the *Vega* when frozen in—The nature of the neighbouring country—The *Vega* is prepared for wintering—Provision-depôt and observatories established on land—The winter dress—Temperature on board—Health and dietary—Cold, wind, and snow—The Chukches on board—Menka's visit—Letters sent home—Nordquist and Hovgaard's excursion to Menka's encampment—Another visit of Menka—The fate of the letters—Nordquist's journey to Pidlin—*Find* of a Chukch grave—Hunting—Scientific work—Life on board—Christmas Eve.

ASSURED that a few hours' southerly wind would be sufficient to break up the belt of ice, scarcely a Swedish mile[1] in breadth, that barred our way, and rendered confident by the above-quoted communications from experts in America concerning the state of the ice in the sea north of Behring's Straits, I was not at first very uneasy at the delay, of which we took advantage by making short excursions on land and holding converse with the inhabitants. First, when day after day passed without any change taking place, it became clear to me that we must make preparations for wintering just on the threshold between the Arctic and the Pacific Oceans. It was an unexpected disappointment, which it was more difficult to bear with equanimity, as it was evident that we would have avoided it if we had come some hours earlier to the eastern side of Kolyutschin Bay. There were numerous occasions during the preceding part of our voyage on which these hours might have been saved: the *Vega*

[1] Equal to 6·64 English miles.

still weak places here and there between the vessel and the land, and a blue sky to the eastward indicated that there was still open water in that direction. That this "clearing" was at a considerable distance from the vessel was seen from an excursion which Dr. Almquist undertook in a north-easterly direction on the 13th October, when, after walking about twenty kilometres over closely packed drift-ice, he was compelled to turn without having reached the open water. It was clear that the *Vega* was surrounded by a band, at least thirty kilometres broad, of drift-ice fields, united by newly formed ice, which in the course of the winter reached a considerable thickness.[1]

In this immense ice-sheet there often arose in the course of the winter cracks of great length. They ran uninterruptedly across newly formed ice-fields, and old, high ground-ices. One of the largest of these cracks was formed on the night before the 15th December right under the bow of the vessel. It was nearly a metre broad, and very long. Commonly the cracks were only some centimetres broad, but, notwithstanding this, they were troublesome enough, because the sea-water forced itself up through them to the surface of the ice and drenched the snow lying next to it.

The causes of the formation of the cracks were twofold. Either they arose from a violent wind disturbing somewhat the position of the newly formed ice, or through the contraction of

[1] When it had become evident that we could make no further advance before next year, Lieut. Brusewitz occasionally measured the thickness of the newly formed ice, with the following results:—

THICKNESS OF THE ICE.

1 December,	56	centimetres.	1 May,	154	centimetres.
1 January,	92	„	15 „	162	„
1 February,	108	„	1 June,	154	„
15 „	120	„	15 „	151	„
1 March,	123	„	1 July,	104	„
1 April,	128	„	15 „	67	„ (full of holes).
15 „	139	„	18 „	The ice broke up.	

the ice in severe cold. The formation of the cracks took place with a more or less loud report, and, to judge from the number of these reports, more frequently than could be observed from the appearance of the snow-covered ice. Thus even during severe cold the apparently continuous ice-sheet was divided into innumerable pieces lying in the close proximity of each other, which either were completely loose or bound together only by the weak ice-band which was gradually formed under the snow on the surface of the water which had forced its way into the crack. Up to a distance of about six kilometres from the shore the ice in any case lay during the course of the whole winter nearly undisturbed, with the exception of the small cracks just mentioned. Farther out to sea, on the other hand, it was in constant motion. So-called *polynias* or open places probably occur here all the year round, and when the weather was favourable we could therefore nearly always see a blue water sky at the horizon from true N.W. to E. A southerly wind after some days brought the open water channel so near the vessel that it was possible to walk to it in a few hours. It then swarmed with seals—an indication that it was in connection with a sea that was constantly open. The neighbourhood of such a sea perhaps also accounts for the circumstance that we did not see a single seal-hole in the ice-fields that surrounded the vessel.

The ground-ice, to which the *Vega* was moored on the 29th September, and under which she lay during the course of the winter, was about forty metres long and twenty-five metres broad; its highest point lay six metres above the surface of the water. It was thus not very large, but gave the vessel good shelter. This ground-ice, along with the vessel and the newly formed ice-field lying between it and the shore, was indeed moved considerably nearer land during the violent autumn storms. A groan or two and a knocking sound in the hull of the vessel indicated that it did not escape very severe pressure; but the *Vega* did not during the course of the winter suffer any

damage, either from this or from the severe cold, during which sharp reports often indicated that some crack in the woodwork had widened through the freezing of the water that had made its way into the vessel. "Cold so that the walls crack" is a well-known expression, with which we inhabitants of the North often connect memories from some stormy winter evening, passed by the home hearth; but here these reports heard in our cabins, especially at night, were unpleasant enough, giving rise to fears that the newly formed or widened cracks would cause dangerous leaks in the vessel's hull. In consequence of iron contracting more than wood under the influence of cold, the heads of the iron bolts, with which the ship's timbers were fastened together, in the course of the winter sank deep into the outside planking. But no serious leak arose in this way, perhaps because the cold only acted on that part of the vessel which lay above the surface of the water.

Already during the first days of our wintering we interpreted various lively accounts of the natives, which they illustrated by signs, to mean that a whaler would be found at Serdze Kamen, in the neighbourhood of the *Vega's* winter haven. On this account Lieutenant Brusewitz was sent out on the 4th October with two men and the little boat, *Louise*, built in Copenhagen for the expedition of 1872-73, and intended for sledge-journeys, with instructions to ascertain, if possible, if such was the case. He returned late at night the same day without having got sight of any vessel. We now supposed that the whole depended on our having misunderstood the accounts of the Chukches. But a letter which I received after our return, from Mr. W. BARTLETT, dated New Bedford, 6th January, 1880, shows that this had not been the case. For he writes, among other things:—

"The writer's son, GIDEON W. BARTLETT, left San Francisco 1st June, 1878, in our freighter ship *Syren*, of 875 tons, for

St. Lawrence Bay, arriving there July 8th, and, after loading 6,100 barrels of oil and 37,000 lbs. of bone from our whalers, she sailed for New Bedford direct, touching at Honolulu to land her bone, to come here *vid* San Francisco, and he joined our whaler bark, *Rainbow*, at St. Lawrence Bay, and went on a tour of observation and pleasure, visiting Point Barrow and going as far east as Lion Reefs, near Camden Bay, and then returning to Point Barrow, and going over to Herald Island, and while there visiting our different whalers, seeing one "bow-head" caught and cut in, and September 25th he came down in the schooner *W. M. Meyer* to San Francisco, arriving there October 22nd. By a comparison of dates we find he passed near Cape Serdze September 29th, or one day after you anchored near Kolyutschin Bay."

The 29th September according to the American day-reckoning corresponds to the 30th according to that of the old world, which was still followed on board the *Vega*. The schooner *W. M. Meyer* thus lay at Serdze Kamen two days after we anchored in our winter haven. The distance between the two places is only about 70 kilometres.

The winter haven was situated in 67° 4′ 49″ north latitude, and 173° 23′ 2″ longitude west from Greenwich, 1·4 kilometres from land. The distance from East Cape was 120′, and from Point Hope near Cape Lisburn on the American side, 180′.

The neighbouring land formed a plain rising gradually from the sea, slightly undulating and crossed by river valleys, which indeed when the *Vega* was frozen in was covered with hoarfrost and frozen, but still clear of snow, so that our botanists could form an idea of the flora of the region, previously quite unknown. Next the shore were found close beds of Elymus, alternating with carpets of *Halianthus peploides*, and further up a poor, even, gravelly soil, covered with water in spring, on which grew only a slate-like lichen, *Gyrophora proboscidea*, and a few flowering plants, of which *Armeria sibirica* was the most common. Within the beach were extensive salt and fresh-water lagoons,

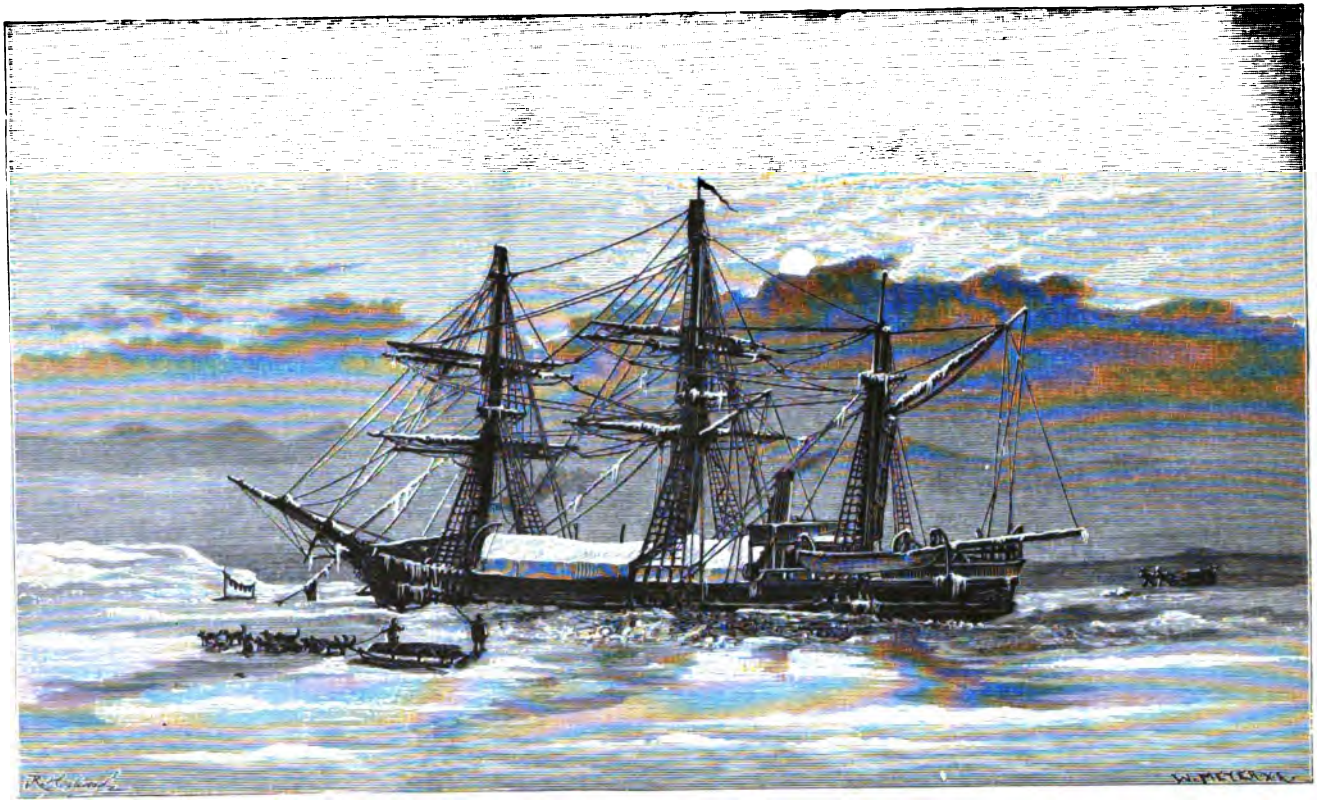
separated by low land, whose banks were covered with a pretty luxuriant carpet, formed of mosses, grasses, and Carices. But first on the neighbouring high land, where the weathered gneiss strata yielded a more fertile soil than the sterile sand thrown up out of the sea, did the vegetation assume a more variegated stamp. No trace of trees[1] was indeed found there, but low willow bushes, entensive carpets of *Empetrum nigrum* and *Andromeda tetragona* were seen, along with large tufts of a species of Artemisia. Between these shoot forth in summer, to judge partly from the dried and frozen remains of plants which Dr. Kjellman collected in autumn, partly from collections made in spring, a limited number of flowering plants, some of which are well known at home, as the red whortleberry, the cloudberry, and the dandelion.

Although experience from preceding Polar journeys and specially from the Swedish expedition of 1872–73, showed that even at the 80th degree of latitude the sea may suddenly break up in the middle of winter, we however soon found, as has been already stated, that we must make preparations for wintering. The necessary arrangements were accordingly made. The snow which collected on deck, and which at first was daily swept away, was allowed to remain, so that it finally formed a layer 30 centimetres thick, of hard tramped snow or ice, which in no inconsiderable degree contributed to increase the resistance of the deck to cold, and for the same purpose snowdrifts were thrown up along the vessel's sides. A stately ice stair was carried up from the ice to the starboard gunwale. A large tent made for the purpose at Karlskrona was pitched from the bridge to the fore, so that only the poop was open. Aft the tent was quite open, the blast and drifting snow having also free entrance from the sides and from an incompletely closed opening in the fore. The protection it yielded against the cold was indeed

[1] Low brush is probably to be met with in the interior of the Chukch peninsula at places which are protected from the cold north winds.

greatly diminished in this way, but instead it did not have the least injurious action on the air on the vessel, a circumstance specially deserving of attention for its influence on the state of health on board. Often under this tent in the dark days of winter there blazed a brisk smithy fire, round which the Chukches crowded in curious wonder at the skill with which the smith fashioned the glowing iron. Here the cook dealt out to the Chukches the soup and meat that were left over, and the loaves of bread which at every baking were baked for them. Here was our reception saloon, where tobacco and sugar were distributed to the women and children; and where sometimes, if seldom, a frozen hunter or fisherman was treated to a little spirits. Here pieces of wood and vertebræ of the whale were valued and purchased, and here tedious negotiations were carried on regarding journeys in dog-sledges in different directions.

The violent motion which took place in the ice during the night before the 15th December, gave us a sharp warning that our position in the open road was by no means so secure as was desirable, but that there was a possibility that the vessel might be nipped suddenly and without any previous warning. If such a misfortune had happened, the crew of the *Vega* would certainly have had no difficulty in getting to land over the ice. But the yield of hunting appeared to be so scanty, and the Chukches were, as almost always, so destitute of all stock of provisions—for they literally obey the command to take no thought for to-morrow—that there was every probability that we, having come safe ashore, would die of hunger, if no provisions were saved from the vessel. This again, as the principal part of the provisions was of course down in the hold, would have been attended with great difficulty, if the *Vega* had been suddenly in the night cut into by the ice at the water-line. In order as far as possible to secure ourselves against the consequences of such a misfortune,



THE "VEGA" IN WINTER QUARTERS.

(After a photograph, taken in the spring of 1879 by L. Palander.)

a depôt of provisions, guns, ammunition, &c., reckoned for 30 men and 100 days, was formed on land. Fortunately we did not require to depend upon it. The stores were laid up on the beach without the protection of lock or bolt, covered only with sails and oars, and no watch was kept at the place. Notwithstanding this, and the want of food which occasionally prevailed among the natives, it remained untouched both by the Chukches who lived in the neighbourhood, and by those who daily drove past the place from distant regions. All however knew very well the contents of the sail-covered heap, and they undoubtedly supposed that there were to be found there treasures of immense value, and provisions enough for the whole population of the Chukch peninsula for a whole year.

The Magnetical Observatory was erected, as will be told in greater detail further on, upon the beach a kilometre and a half from the vessel. To this house the observers had to walk to and fro at least four times in the twenty-four hours over an ice-field, covered with loose snow, as fine as dust, that was set in motion by the least puff of wind, and then in a few moments completely obliterated every footprint. When the moon did not shine, the winter nights were so dark, that it was impossible to distinguish the very nearest objects, and day after day during the course of the winter we had, besides, drifting snow so thick that the high dark hull of the vessel itself could be distinguished only when one was in its immediate neighbourhood! In walking from land during the darkness of the night and in drifting snow it would have been very difficult to find one's way to the vessel without guidance, and he would have been helplessly lost who went astray. To prevent such an accident, the precaution was taken of running a line over high ice-pillars between the Observatory and the vessel. Even with the help of the guide-line it was often difficult enough to find our way.

The attempt to keep open a channel in the ice round the vessel during the whole winter had soon to be given up, but two

holes were kept constantly open, one by the side of the vessel in case of fire, and the other for the tidal observations which Captain Palander set on foot during the winter. The latter hole was chosen by a little seal as its haunt for a long time, until one day we entertained ourselves by catching him with the necessary care, and making him pay an involuntary visit on board, where he was offered various delicacies, which however were disregarded. The seal was let loose again in his hole, but notwithstanding the friendliness we showed him, he never more returned.

From the meteorological observations it appears that the winter was not so cold as the winters in the Franklin archipelago or in the coldest parts of the mainland of Siberia.[1] On the other hand, it was exceedingly stormy at the *Vega's* winter station, and day after day, night after night, we have gone to and from the Observatory in a high wind and a cold of −30° to −46° C. In calm weather a cold of −40° is scarcely very troublesome, but with only a slight draught a degree of cold of for instance −35° is actually dangerous for one who goes against the wind, and without the necessary precautions exposes uncovered parts of the face, the hands, or the wrists, to the cold current of air. Without one's being warned by any severe pain frostbite arises, which, if it be not in time thawed by rubbing the injured part with the hand, or with melting snow, may readily become very serious. Most of those who for the first time took part in a wintering in the high north, were, when the first cold occurred, more or less frostbitten, on several occasions so that there arose high frost-blisters filled with bloody water, several

[1] According to H. Wild's newly-published large work, "*Die Temperatur Verhältnisse des Russischen Reiches*, 2e Hälfte, St. Petersburg, 1881," the Old World's cold-pole lies in the neighbourhood of the town Werchojansk (67° 34′ N.L. 133° 51′ E.L. from Greenwich). The mean temperature of the different months and of the whole year is given in the note at page 411. If the data on which these figures rest are correct, the winter at Werchojansk is immensely colder than at the *Vega's* winter station.

square centimetres in extent, but fortunately never to such a degree that any serious bad results followed. After we, new-

THE WINTER DRESS OF THE "VEGA" MEN.

comers to the Polar regions, warned by experience, became more careful, such frostbites occurred but seldom. Nor did there

occur a single case of frostbite in the feet. To this conduced our clothing, which was adapted to the climate, and, besides good winter clothes of the sort commonly used in Sweden, consisted of the following articles of dress brought with us specially for use in the high north:—

1. An abundant stock of good *woollen under-clothing.*

2. A carefully made *blouse of sailcloth,* provided with many pockets, intended to be drawn over the ordinary seaman's dress as a protection against wind and drifting snow. This proved to be very suitable for the purpose for which it was intended, and was much liked by the crew.

3. A Lapp "*pesk*" *with leggins* was not so often used, because it was so warm that it was only with difficulty one could walk with it any considerable distance. On the other hand, in the case of winter journeys with dogs or reindeer it was indispensable.

4. A pair of very large *canvas boots* with leather soles. Inside these was put hay of *Carex vesicaria* L. The foot itself was covered with one or two pairs of stockings, above which there was a foot-strip of felt. Our boots were thus intermediate between the foot-covering introduced by Parry for Arctic journeys, and the hay-filled *komager* of the Lapps. All who used these canvas boots are unanimous in thinking that they left nothing to desire. Even in the case of extended excursions in wet snow they are to be preferred to leather shoes; for the latter become heavy and drenched with water, and can with difficulty be dried in the open air in the course of a night's rest. Canvas boots and the long hay in them on the other hand are easily dried in a single night. They are also light when wet, and in that state little prejudicial to health on account of the change of air which the hay under the foot renders possible. I therefore am of opinion that we are warranted in giving such boots the highest recommendation for winter journeys and winter hunting excursions, even in our own land.

5. An *Öresund cap* and a loose *felt hood* (baschlik) of the

same sort as those which are used in the Russian army. I had bought the baschliks in St. Petersburg on account of the Expedition.

6. *Fingerless gloves* of sealskin and chamois, with an inside lining of sheepskin and at the wrists bordered with long-haired fur. They were commonly carried with a band from the neck, as children are wont to carry their gloves. For outside work these thick gloves were too inconvenient; then fingerless woollen mittens were used.

7. *Coloured spectacles*, which were distributed to all the men in the beginning of February. One must himself have lived in the Polar regions during winter and spring, "after the return of the sun," to understand how indispensable is such a protection from the monotonous white light which then surrounds the eye in every direction. The inexperienced, though warned, seldom observe the necessary precautions, and commonly pay the penalty by a more or less complete snowblindness, which indeed is not very dangerous, but is always exceedingly painful, and which lasts several days.

On board the vessel in our cabins and collection-rooms it was besides by no means so cold as many would suppose. The sides of the vessel in several places indeed, especially in the cabins, were covered with a thick sheet of ice, and so was the skylight in the gun-room. But in the inhabited parts of the vessel we had, a little from the sides, commonly a temperature of +12° to +17°, that is to say about the same as we in the north are wont to have indoors in winter, and certainly higher than the temperature of rooms during the coldest days of the year in many cities in the south, as for instance in Paris and Vienna. By night however the temperature in the cabins sank sometimes to + 5° and + 10°, and the boarding at the side of the berth became covered with ice. In the work-room 'tweendecks the thermometer generally stood about + 10°, and even in the underhold, which was not heated,

but lay under the water-line, the temperature was never under, commonly 1° or 2° above, the freezing-point.

Much greater inconvenience than from cold did we in the cabins suffer from the excessive heat and the fumes, which firing in large cast-iron stoves is wont to cause in small close rooms. When in the morning after a cold night the watch all too willingly obeyed the direction, which sounded from different quarters, to fire well, one had often his wish so thoroughly satisfied, that, in half an hour after, every man lay bathed in perspiration. There was no other help for it than to leave the cabin, take a cold bath and a good rub down, dress rapidly, rush on deck for fresh air, and cool in the temperature of −30° to −40° prevailing there. Other opportunities for bathing were also given both to the officers and crew, and the necessary care was taken to secure cleanliness, a sanitary measure which ought never to be neglected in Arctic winterings.

The state of health on board during the course of the winter was exceedingly good. Dr. Almquist's report enumerates only a few serious maladies, all successfully cured, among which may be mentioned stomach colds and slight cases of inflammation of the lungs, but not a single case of that insidious disease, scurvy, which formerly raged in such a frightful way among the crews in all long voyages, and which is still wont to gather so many victims from among Polar travellers.

This good state of health depended in the first place on the excellent spirit which inspired the scientific men, the officers and the crew of the Expedition, but it ought also to be ascribed to the suitable equipment of the *Vega*, arranged by Captain Palander at Karlskrona, and above all to adjustment to the climate of our dietary, which was settled on the ground of the experience gained in the expedition of 1872–73, and after taking the advice of its distinguished physician Dr. Envall. The dietary is shown in the following table :—

No. 1. SUNDAY.

Breakfast: butter 6 ort, coffee 10 ort, sugar 7·5 ort.[1]
Dinner: salt pork or dried fish 75 ort, sourkrout 75 ort, preserved or fresh potatoes 12 ort, preserved vegetables 5·5 ort, extract of meat 1·5 ort, raisins 5 ort, rice 50 ort, brandy or rum 2 cubic inches.
Supper: butter 6 ort, tea 1·5 ort, sugar 7·5 ort, barley-groats 10 cubic inches, cheese 12 ort.

No. 2. MONDAY, WEDNESDAY, and FRIDAY.

Breakfast same as No. 1.
Dinner: preserved meat or fish 1 portion, preserved potatoes 12 ort, preserved vegetables 5·5 ort, preserved leeks 1 portion, extract of meat 1·5 ort, brandy or rum 2 cubic inches.
Supper same as No. 1 without cheese.

No. 3. THURSDAY.

Breakfast same as No. 1.
Dinner: salt pork 1 lb., peas 10 cubic inches, extract of meat 1·5 ort, barley-groats 2 cubic inches, brandy or rum 2 cubic inches.
Supper same as No. 2.

No. 4. TUESDAY.

Breakfast: butter 6 ort, chocolate 10 ort, sugar 7·5 ort.
Dinner: salt meat 1 lb., maccaroni 15 ort (or brown beans 10 cubic inches or green peas 1 portion), fruit soup 1 portion, brandy or rum 2 cubic inches.
Supper same as No. 2.

No. 5. SATURDAY.

Breakfast same as No. 4.
Dinner: preserved beeksteak or stewed beef 1 portion, preserved or fresh potatoes 12 ort, preserved leeks 1 portion, fruit soup 1 portion, brandy or rum 2 cubic inches.
Supper same as No. 2.

Every man besides had served out to him daily 1¼ lb. dried bread or flour (⅔ wheat and ⅓ rye), 3 ort tobacco and 2 cubic

[1] 1 lb. = 100 ort = 425·05 gram. 1 kanna = 100 cubic inches = 2·617 litres.

inches vinegar; and weekly 1 lb. wheat-flour, 30 ort butter, 21 ort salt, 7 ort mustard, 3 ort pepper, and two cubic inches vinegar.

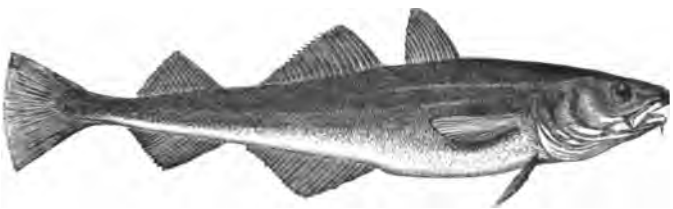
Besides what is included in the above list, "multegröt" (preserved cloudberries), mixed with rum, was served out twice a week from the 15th February to the 1st April. I would willingly have had a larger quantity of this, according to northern experience, excellent antidote to scurvy, but as the cloudberry harvest completely failed in 1877, I could not, at any price, procure for the Expedition the quantity that was required. There was purchased in Finland instead, a large quantity of cranberry-juice, which was regularly served out to the crew and much liked by them. We carried with us besides a pair of living swine, which were slaughtered for the Christmas festivities.[1] All the men at that time had an opportunity of eating fresh pork twice a week, an invaluable interruption to the monotonous preserved provisions, which in its proportion conduced, during this festival, to which we inhabitants of the North are attached by so many memories, to enliven and cheer us.

The produce of hunting was confined during the course of the winter to some ptarmigan and hares, and thus did not yield any contribution worth mentioning to the provisioning of the vessel. On the other hand, I was able by barter with the natives to procure fish in considerable abundance, so that at certain seasons the quantity was sufficient to allow of fresh fish being served out once a week. The kind of fish which was principally obtained during the winter, a sort of cod with greyish-green vertebræ, could however at first only be served in the gun-room, because the crew, on account of the colour of its bones, for a long time had an invincible dislike to it.

[1] To carry animals for slaughter on vessels during Polar expeditions cannot be sufficiently recommended. Their flesh acts beneficially by forming a change from the preserved provisions, which in course of time become exceedingly disagreeable, and their care a not less important interruption to the monotony of the winter life.

On many of the ground-ices in the neighbourhood of the vessel there were fresh-water collections of considerable depth, which indeed were already hard frozen on the surface, but long yielded us splendid water for drinking and washing. After the 14th of December, when all the smaller fresh-water collections were almost frozen to the bottom, and salt-water had made its way into the largest ones and those on which we most depended, it became necessary to procure water by melting ice.

The meteorological observations were made every fourth hour up to the 1st November; after that to the 1st April every hour; after that again six times in the twenty-four hours. From the 27th November to the 1st April the thermometers were set up on



COD FROM PITLEKAJ.
Gadus navaga, Kölreuter.
Half the natural size.

land at the magnetical observatory; before and after that time in the immediate neighbourhood of the vessel. During winter the charge of the meteorological observations was intrusted to Dr. Stuxberg, who at that season, when all around us was covered with ice, was compelled to let his own zoological researches rest.

The state of the weather of course had a very sensible influence on our daily life, and formed the touchstone by which our equipment was tested. Space does not permit me to give in this work the detailed results of the meteorological observations. I shall therefore only state the following facts.

The greatest cold which was observed during the different months was in

October	the 24th – 20°·8	March	the 29th – 39°·8
November	the 30th – 27°·2	April	the 15th – 38°·0
December	the 23rd – 37°·1	May	the 3rd – 26°·8
January	the 25th – 45°·7	June	the 3rd – 14°·3
February	the 2nd – 43°·8	July	the 2nd – 1°·0

Twice we had the barometer uncommonly high, viz.:

On the 22nd December 6 A.M. 782·0 (0°) mm.
On the 17th February 6 A.M. 788·1 (0°) mm.

The lowest atmospheric pressure, 728·8 (0°) mm., occurred on the 31st December at two o'clock P.M.

The weather during the winter was very stormy, and the direction of the wind nearest the surface of the earth almost constantly between north-west and north-north-west. But already in atmospheric strata of inconsiderable height there prevailed, to judge by the direction of the clouds, a similar uninterrupted atmospheric current from the south-east, which when it occasionally sank to the surface of the earth brought with it air that was warmer and less saturated with moisture. The reason of this is easy to see, if we consider that Behring's Straits form a gate surrounded by pretty high mountains between the warm atmospheric area of the Pacific and the cold one of the Arctic Ocean. The winds must be arranged here approximately after the same laws as the draught in the door-opening between a warm and a cold room, that is to say, the cold current of air must go below from the cold room to the warm, the warm above from the warm room to the cold. The mountain heights which, according to the statement of the natives, are to be found in the interior of the Chukch peninsula besides conduce to the heat and dryness of the southerly and south-easterly winds. For they confer on the sea winds that pass over their summits the properties of the *föhn* winds. Our coldest winds have come from S.W. to W., that is to say, from the Old World's pole of cold, situated in

the region of Werchojansk. On the existence of two currents of air, which at a certain height above the surface of the earth contend for the mastery, depends also the surprising rapidity with which the vault of heaven in the region of Behring's Straits becomes suddenly clouded over and again completely clear. Already the famous Behring's Straits' navigator, RODGERS, now Admiral in the American Navy, had noticed this circumstance, and likened it very strikingly to the drawing up and dropping of the curtain of a theatre.

In our notes on the weather a difference was always made between *snōyra* (fall of snow in wind) and *yrsnō* (snow-storm without snow-fall). The fall of snow was not very great, but as there was in the course of the winter no thaw of such continuance that the snow was at any time covered with a coherent melted crust, a considerable portion of the snow that fell remained so loose that with the least puff of wind it was whirled backwards and forwards. In a storm or strong breeze the snow was carried to higher strata of the atmosphere, which was speedily filled with so close and fine snow-dust, that objects at the distance of a few metres could no longer be distinguished. There was no possibility in such weather of keeping the way open, and the man that lost his way was helplessly lost, if he could not, like the Chukch snowed up in a drift, await the ceasing of the storm. But even when the wind was slight and the sky clear there ran a stream of snow some centimetres in height along the ground in the direction of the wind, and thus principally from N.W. to S.E. Even this shallow stream heaped snowdrifts everywhere where there was any protection from the wind, and buried more certainly, if less rapidly, than the drifting snow of the storm, exposed objects and trampled footpaths. The quantity of water, which in a frozen form is removed in this certainly not deep, but uninterrupted and rapid current over the north coast of Siberia to more southerly regions, must be equal to the mass of water in the giant rivers of our globe, and play

a sufficiently great *rôle*, among others as a carrier of cold to the most northerly forest regions, to receive the attention of meteorologists.

The humidity of the air was observed both by August's psychrometer and Saussure's hygrometer. But I do not believe that these instruments give trustworthy results at a temperature considerably under the freezing-point. Moreover the degree of humidity at the place where there can be a question of setting up a psychrometer and hygrometer during a wintering in the high north, has not the meteorological importance which has often been ascribed to it. For the instruments are as a rule set up in an isolated louvre case, standing at a height above the surface convenient for reading. While the snow is drifting almost uninterruptedly it is impossible to keep this case clear of snow. Even the air, which was originally quite dry, must here be saturated with moisture through evaporation from the surrounding layers of snow and from the snow dust which whirls about next the surface of the earth. In order to determine the true degree of humidity in the air, I would accordingly advise future travellers to these regions to weigh directly the water which a given measure of air contains by absorbing it in tubes with chloride of calcium, calcined sulphate of copper, or sulphuric acid. It would be easy to arrange an instrument for this purpose so that the whole work could be done under deck, the air from any stratum under the mast-top being examined at will. If I had had the means to make such an examination at the *Vega's* winter quarters, it would certainly have appeared that the relative humidity of the air at a height of some few metres above the surface of the earth was for the most part exceedingly small.

The sandy neck of land which on the side next the vessel divided the lagoons from the sea, was bestrewn with colossal bones of the whale, and with the refuse of the Chukches, who had lived and wandered about there for centuries, and besides

with portions of the skeleton of the seal and walrus, with the excreta of men, dogs, birds, &c. The region was among the most disagreeable I have seen in any of the parts inhabited by fishing Lapps, Samoyeds, Chukches, or Eskimo. When the *Vega* was beset there were two Chukch villages on the neighbouring beach, of which the one that lay nearest our winter haven was called Pitlekaj. It consisted at first of seven tents, which in consequence of want of food their inhabitants removed gradually in the course of the winter to a region near Behring's Straits, where fish were more abundant. At the removal only the most indispensable articles were taken along, because there was an intention of returning at that season of the year when the chase again became more productive. The other encampment, Yinretlen, lay nearer the cape towards Kolyutschin Bay, and reckoned at the beginning of our wintering likewise seven tents, whose inhabitants appeared to be in better circumstances than those of Pitlekaj. They had during the autumn made a better catch and collected a greater stock. Only some of them accordingly removed during winter.

The following encampments lay at a somewhat greater distance from our winter quarters, but so near, however, that we were often visited by their inhabitants:

Pidlin, on the eastern shore of Kolyutschin Bay, four tents.

Kolyutschin, on the island of the same name, twenty-five tents. This village was not visited by any of the members of the *Vega* Expedition.

Rirajtinop, situated six kilometres east of Pitlekaj, three tents.

Irgunnuk, seven kilometres east of Pitlekaj, ten tents, of which, however, in February only four remained. The inhabitants of the others had for the winter sought a better fishing place farther eastward.

The number of the persons who belonged to each tent was difficult to make out, because the Chukches were constantly visiting each other for the purpose of gossip and talk. On an

average it may perhaps be put at five or six persons. Including the inhabitants of Kolyutschin Island, there thus lived about 300 natives in the neighbourhood of our winter quarters.

When we were beset, the ice next the shore, as has been already stated, was too weak to carry a foot passenger, and the difficulty of reaching the vessel from the land with the means which the Chukches had at their disposal was thus very great. When the natives observed us, there was in any case immediately a great commotion among them. Men, women,

KAUTLJKAU, A CHUKCH GIRL FROM IRGUNNUK.
Front face and Profile.
(After photographs by L. Palander.)

children, and dogs were seen running up and down the beach in eager confusion; some were seen driving in dog-sledges on the ice street next the sea. They evidently feared that the splendid opportunity which here lay before them of purchasing brandy and tobacco, would be lost. From the vessel we could see with glasses how several attempts were made to put out boats, but they were again given up, until at last a boat was got to a lane, clear of ice or only covered with a thin sheet, that ran

from the shore to the neighbourhood of the vessel. In this a large skin boat was put out, which was filled brimful of men and women, regardless of the evident danger of navigating such a boat, heavily laden, through sharp, newly formed ice. They rowed immediately to the vessel, and on reaching it most of them climbed without the least hesitation over the gunwale with jests and laughter, and the cry *anoaj anoâj* (good day, good day). Our first meeting with the inhabitants of this region, where we afterwards passed ten long months, was on both sides very hearty, and formed the starting-point of a very friendly relation between the Chukches and ourselves, which remained unaltered during the whole of our stay.

Regard for cleanliness compelled us to allow the Chukches to come below deck only exceptionally, which at first annoyed them much, so that one of them even showed a disposition to retaliate by keeping us out of the bedchamber in his tent. Our firmness on this point, however, combined with friendliness and generosity, soon calmed them, and it was not so easy for the men to exclude us from the inner tent, for in such visits we always had confections and tobacco with us, both for themselves and for the women and children. On board the vessel's tent-covered deck soon became a veritable reception saloon for the whole population of the neighbourhood. Dog-team after dog-team stood all day in rows, or more correctly lay snowed up before the ice-built flight of steps to the deck of the *Vega*, patiently waiting for the return of the visitors, or for the pemmican I now and then from pity ordered to be given to the hungered animals. The report of the arrival of the remarkable foreigners must besides have spread with great rapidity. For we soon had visits even from distant settlements, and the *Vega* finally became a resting-place at which every passer-by stopped with his dog-team for some hours in order to satisfy his curiosity, or to obtain in exchange for good words or some more acceptable wares a little warm food, a bit of tobacco, and sometimes when

the weather was very stormy, a little drop of spirits, by the Chukches called *ram*, a word whose origin is not to be sought for in the Swedish-Norwegian *dram*, but in the English word *rum*.

All who came on board were allowed to go about without let or hindrance on our deck, which was encumbered with a great many things. We had not however to lament the loss of the merest trifle. Honesty was as much at home here as in the huts of the reindeer Lapps. On the other hand, they soon became very troublesome by their beggary, which was kept in bounds by no feeling of self-respect. Nor did they fail to take all possible advantage of what they doubtless considered the great inexperience of the Europeans. Small deceptions in this way were evidently not looked upon as blameworthy, but as meritorious. Sometimes, for instance, they sold us the same thing twice over, they were always liberal in promises which they never intended to keep, and often gave deceptive accounts of articles which were exposed for sale. Thus the carcases of foxes were offered, after having been flayed and the head and feet cut off, on several occasions as hares, and it was laughable to see their astonishment at our immediately discovering the fraud. The Chukches' complete want of acquaintance with money and our small supply of articles for barter for which they had a liking besides compelled even me to hold at least a portion of our wares at a high price. Skins and blubber, the common products of the Polar lands, to the great surprise of the natives, were not purchased on the *Vega*. On the other hand a complete collection of weapons, dresses, and household articles was procured by barter. All such purchases were made exclusively on account of the Expedition, and in general the collection of natural and ethnographical objects for private account was wholly forbidden, a regulation which ought to be in force in every scientific expedition to remote regions.

As the Chukches began to acquire a taste for our food, they

never neglected, especially during the time when their hunting failed, to bring daily on board driftwood and the vertebræ and other bones of the whale. They bartered these for bread. A load of five bits of wood, from four to five inches in diameter and six feet long, was commonly paid for with two or three ship biscuits, that is to say with about 250 gram bread, the vertebra of a whale with two ship biscuits, &c. By degrees two young natives got into the habit of coming on board daily for the purpose of performing, quite at their leisure, the office of servant. The cook was their patron, and they obtained from him in compensation for their services the larger share of the left victuals. So considerable a quantity of food was distributed partly as payment for services rendered or for goods purchased, partly as gifts, that we contributed in a very great degree to mitigate the famine which during midwinter threatened to break out among the population.

None of the natives in the neighbourhood of the *Vega's* winter station professed the Christian religion. None of them spoke any European language, though one or two knew a couple of English words and a Russian word of salutation. This was a very unfortunate circumstance, which caused us much trouble. But it was soon remedied by Lieut. Nordquist specially devoting himself to the study of their language, and that with such zeal and success that in a fortnight he could make himself pretty well understood. The natives stated to DE LONG in the autumn of 1879 that a person on the "man of war" which wintered on the north coast, spoke Chukch exceedingly well. The difficulty of studying the language was increased, to a not inconsiderable degree, by the Chukches in their wish to co-operate with us in finding a common speech being so courteous as not to correct, but to adopt the mistakes, in the pronunciation or meaning of words that were made on the *Vega*. As a fruit of his studies Lieut. Nordquist has drawn up an extensive vocabulary of this little known language, and given a sketch of its grammatical

structure.[1] The knowledge of the Chukch language, which the other members of the Expedition acquired, was confined to a larger or smaller number of words; the natives also learned a word or two of our language, so that a *lingua franca* somewhat intelligible to both parties gradually arose, in which several of the crew soon became very much at home, and with which in

[1] I give here an extract from the Vocabulary, that the reader may form some idea of the language of the north-east point of Asia:—

Tnáergin, heaven.
Tirkir, the sun.
Yédlin, the moon.
Angátlingan, a star.
Nútatschka, land.
Ángka, sea.
Ljédljenki, winter.
Édljek, summer.
Edljóngat, day.
Nekita, night.
Áyguon, yesterday.
Ietkin, to-day.
Ergátti, to-morrow.
Gnúnian, north.
Emnungku, south.
Nikáyan, east.
Kayradljgin, west.
Tintin, ice.
Átljatlj, snow.
Yeetedli, the aurora.
Yengeen, mist.
Tédljgio, storm.
Éek, fire.
Kljautlj, a man, a human being.
Oráedlja, men.
Neáiren, a woman.
Nénena, a child.
Empenátschyo, father.
Émpengau, mother.
Ljéut, head.
Ljeutljka, face.
Dljedljádlin, eye.
Liljáptkórgin, to see.
Huedljódlin, ear.
Huedljokodljáurgin, to hear.
Huádljomerkin, to understand.
Huedljountákurgin, not to understand.
Yeká, nose.
Yekergin, mouth.
Kametkuaurgin, to eat.
Yedlinedljourgin, to speak.
Mámmah, a woman's breast.
Mammatkórgin, to give suck.
Yéet, foot.
Retschaurgin, to stand.
Yetkatjergin, to lie.
Tschipiska, to sleep.
Kadljetschetuetjákurgin, to learn.
Pintekatkórgin, to be born.
Kaertráljirgin, to die.
Kámakatan, to be sick.
Kámak, the Deity, a guardian Spirit.
Yáranga, tent.
Etschengeratlin, lamp.
Órguor, sledge.
Atkuát, boat.
Anetljkatlj, fishing-hook.
Anedljourgin, to angle.
Uádlin, knife.
Tschúpak, *Kámeak*, dog.
Úmku, Polar bear.
Rérka, walrus.
Mémetlj, seal.
Kórang, reindeer.
Gátlje, bird.
Enne, fish.
Gúrgur, dwarf-birch.
Kukatkokongadlin, willow-bush.
Gem, I.
Gemnin, mine.
Get, you.
Genin, yours.
Enkan, he.
Muri, we.
Turi, you.
Máyngin, much.
Pljúkin, little.
Konjpong, all.
I, yes.
Etlje, no.
Métschinka, thanks.
Énnen, one.
Nirak, two.
Nrok, three.
Nrak, four.
Metljingan, five.

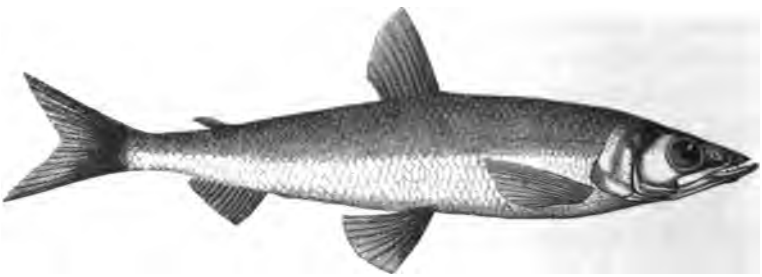
CHUKCHES ANGLING.

case of necessity one could get along very well, although in this newly formed dialect all grammatical inflections were totally wanting. Besides, I set one of the crew, the walrus-hunter Johnsen, free for a considerel time from all work on board, in order that he might wander about the country daily, partly for hunting, partly for conversing with the natives. He succeeded in the beginning of winter in killing some ptarmigan and hares, got for me a great deal of important information regarding the mode of life of the Chukches, and procured several valuable ethnographical objects. But after a time, for what reason I could never make out, he took an invincible dislike to visit the Chukch tents more, without however having come to any disagreement with their inhabitants.

ICE-SIEVE.
One-eighth of the natural size.

On the 5th October the openings between the drift-ice fields next the vessel were covered with splendid skating ice, of which we availed ourselves by celebrating a gay and joyous skating festival. The Chukch women and children were now seen fishing for winter roach along the shore. In this sort of fishing a man, who always accompanies the fishing women, with an iron-shod lance cuts a hole in the ice so near the shore that the distance between the under corner of the hole and the bottom is only half a metre. Each hole is used only by one woman, and that only for a short time. Stooping down at the hole, in which the surface of the water is kept quite clear of pieces of ice by means of an ice-sieve, she endeavours to attract the fish by means of a peculiar wonderfully clattering cry. First when a fish is seen in

the water an angling line, provided with a hook of bone, iron or copper, is thrown down, strips of the entrails of fish being employed as bait. A small metre-long staff with a single or double crook in the end was also used as a fishing implement. With this little leister the men cast up fish on the ice with incredible dexterity. When the ice became thicker, this fishing was entirely given up, while during the whole winter a species of cod and another of grayling were taken in great quantity in a lagoon situated nearer Behring's Straits. The coregonus is also caught in the inland lakes, although, at least at this season of the year, only in limited quantity.



SMELT FROM THE CHUKCH PENINSULA.
Osmerus eperlanus, Lin.
Half the natural size.

On the morning of the 6th October, we saw from the vessel an extraordinary procession moving forward on the ice. A number of Chukches drew a dog-sledge on which lay a man. At first we supposed it was a man who was very ill, and who came to seek the help of the physician, but when the procession reached the vessel's side, the supposed invalid climbed very nimbly up the ice-covered rope-ladder (our ice-stair was not yet in order), stepped immediately with a confident air, giving evidence of high rank, upon the half-deck, crossed himself, saluted graciously, and gave us to know in broken Russian that he was a man of importance in that part of the country. It

now appeared that we were honoured with a visit from the representative of the Russian empire, WASSILI MENKA, the starost among the reindeer-Chukches. He was a little dark man, with a pretty worn appearance, clad in a white variegated "pesk" of reindeer skin, under which a blue flannel shirt was visible. In order immediately on his arrival to inspire us with respect, and perhaps also in order not to expose his precious

WASSILI MENKA.
Starost among the Reindeer Chukches.
(After a photograph by L. Palander.)

life to the false Ran's treachery, he came to the vessel over the yet not quite trustworthy ice, riding in a sledge that was drawn not by dogs but by his men. On his arrival he immediately showed us credentials of his rank, and various evidences of the payment of tribute (or market tolls), consisting of some few red and some white fox-skins, reckoning the former at 1 rouble 80 copecks, the latter at 40 copecks each.

He was immediately invited down to the gunroom, entertained after the best of our ability, and bothered with a number of questions which he evidently understood with difficulty, and answered in very unintelligible Russian. He was in any case the first with whom some of us could communicate, at least in a way. He could neither read nor write. On the other hand, he could quickly comprehend a map which was shown him, and point out with great accuracy a number of the more remarkable places in north-eastern Siberia. Of the existence of the Russian emperor the first official of the region had no idea; on the other hand, he knew that a very powerful person had his home at Irkutsk. On us he conferred the rank of "Ispravnik" in the neighbouring towns. At first he crossed himself with much zeal before some photographs and copper-plate engravings in the gunroom, but he soon ceased when he observed that we did not do likewise. Menka was accompanied by two badly-clad natives with very oblique eyes, whom we took at first for his servants or slaves. Afterwards we found that they were owners of reindeer, who considered themselves quite as good as Menka himself, and further on we even heard one of them speak of Menka's claim to be a chief with a compassionate smile. Now, however, they were exceedingly respectful, and it was by them that Menka's gift of welcome, two reindeer roasts, was carried forward with a certain stateliness. As a return present we gave him a woollen shirt and some parcels of tobacco. Menka said that he should travel in a few days to Markova, a place inhabited by Russians on the river Anadyr, in the neighbourhood of the old Anadyrsk. Although I had not yet given up hope of getting free before winter, I wished to endeavour to utilize this opportunity of sending home accounts of the *Vega's* position, the state of matters on board, &c. An open letter was therefore written in Russian, and addressed to his Excellency the Governor-General at Irkutsk, with the request that he would communicate its contents to his Majesty, King

Oscar. This was placed, along with several private sealed letters between a couple of pieces of board, and handed over to Menka with a request to give them to the Russian authorities at Markova. At first it appeared as if Menka understood the letter as some sort of further credentials for himself. For when he landed he assembled, in the presence of some of us, a circle of Chukches round himself, placed himself with dignity in their midst, opened out the paper, but so that he had it upside down, and read from it long sentences in Chukch to an attentive audience, astonished at his learning. Next forenoon we had another visit of the great and learned chief. New presents were exchanged, and he was entertained after our best ability. Finally he danced to the chamber-organ, both alone and together with some of his hosts, to the great entertainment of the Europeans and Asiatics present.

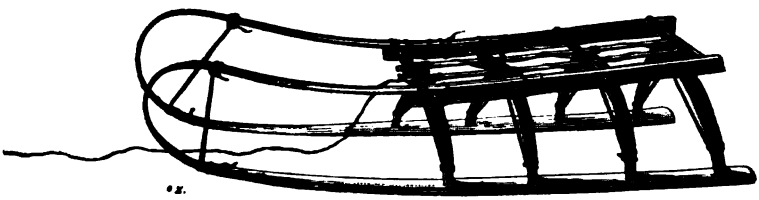
As the state of the ice was still unaltered, I did not neglect the opportunity that now offered of making acquaintance with the interior of the country. With pleasure, accordingly, I gave Lieutenants Nordquist and Hovgaard permission to pay a visit to Menka's encampment. They started on the morning of the 8th October. Lieut. Nordquist has given me the following account of their excursion:—

"On Tuesday, the 8th October, at 10 o'clock A.M. Lieut. Hovgaard and I travelled from Pitlekaj in dog-sledges into the interior in a S.S.E. direction. Hovgaard and I had each a Chukch as driver. Menka had with him a servant, who almost all the time ran before as guide. My comrade's sledge, which was heaviest, was drawn by ten dogs, mine by eight, and Menka's, which was the smallest and in which he sat alone, by five. In general the Chukches appear to reckon four or five dogs sufficient for a sledge with one person.

"The *tundra*, with marshes and streams scattered over it, was during the first part of our way only gently undulating, but the farther we went into the interior of the country the more uneven it became, and when, at 8 o'clock next morning, we reached the goal of our journey—Menka's brother's camp—

we found ourselves in a valley, surrounded by hills, some of which rose about 300 metres above their bases. A portion of the vegetable covering the *tundra* could still be distinguished through the thin layer of snow. The most common plants on the drier places were *Aira alpina* and *Poa alpina;* on the more low-lying places there grew Glyceria, Pedicularis, and *Ledum palustre;* everywhere we found *Petasites frigida* and a species of Salix. The latter grew especially on the slopes in great masses, which covered spots having an area of twenty to thirty square metres. At some places this bush rose to a height of about a metre above the ground. The prevailing rock appeared to be granite. The bottoms of the valleys were formed of post-Tertiary formations, which most frequently consisted of sand and rolled stones, as, for instance, was the case in the great valley in which Menka's brother's camp was pitched.

"When, on the morning of the 9th, we came to the camp there met us some of the principal Chukches. They saluted



CHUKCH DOG-SLEDGE.

Menka in the Russian way, by kissing him first on both cheeks and then on the mouth. The Chukches however, appear to be very averse to this ceremony, and scarcely ever touched each other with the mouth. Us they saluted in the common way, by stretching out the hand and bowing themselves. We then went into Menka's brother's tent, in front of which the whole inhabitants of the encampment were speedily assembled to look at us. The camp consisted of eighteen tents, pitched on both sides of a river which ran through the valley. The tents were inhabited by reindeer-Chukches, who carry on traffic between the Russians and a tribe living on the other side of Behring's Straits, whom they call *Yekargaules*. Between the tents we saw a great number of sledges, both empty and loaded. Some of these were light and low sledges for driving in, with runners bent upwards and backwards, others were heavier pack-sledges, made of stronger wood, with the runners not bent back.

Some of the light sledges were provided with tilts of splints covered with reindeer skins; others were completely covered, having an entrance only in front.

"The knives, axes, boring tools, &c., which I saw were of iron and steel, and had evidently been obtained from Americans or Russians. The household articles in Menka's brother's tent consisted of some copper coffee-pots, which were used for boiling water, a german-silver beaker with an English inscription, two teacups with saucers, flat wooden trays, and barrels. The dress of the reindeer-Chukches is similar to that of the coast-Chukches, only with this difference, that the former use reindeer-skins exclusively, while the latter employ seal-skin in addition. Some, on our arrival, put on blouses of variegated cloth, probably of Russian manufacture. Among ornaments may be mentioned glass-beads, strung on sinews, which were worn in the ears or on the neck, chiefly by the women. These were tattooed in the same way as those of the coast-Chukches. I saw here, however, an old woman, who, besides the common tattooing of the face, was tattooed on the shoulders, and another, who, on the outside of the hands, had two parallel lines running along the hand and an oblique line connecting them. The men were not tattooed. Two of them carried crosses, with Slavonic inscriptions, at the neck, others carried in the same way forked pieces of wood. Whether these latter are to be considered as their gods or as amulets I know not.

"As we could not obtain here the reindeer that we wished to purchase on account of the expedition, we betook ourselves with our dogs on the afternoon of the same day along with Menka to his son-in-law's encampment, which we reached at 8 o'clock in the evening. We were received in a very friendly way, and remained here over night. All the inhabitants of the tent sleep together in the bedchamber of it, which is not more than 2 to 2·4 metres long, 1·8 to 2 metres broad, and 1·2 to 1·5 metres high. Before they lie down they take supper. Men and women wear during the night only a *cingulum pudicitiæ*, about fifteen centimetres broad, and are otherwise completely naked. In the morning the housewife rose first and boiled a little flesh, which was then served in the bedchamber, before its inmates had put on their clothes. She cut the meat in slices in a tray, and distributed them afterwards. In the morning we saw the Chukches catch and slaughter their reindeer. Two men go into the herd, and when they have got sight of a reindeer which they wish to have, they cast, at a distance of nine or ten metres, a running noose over the animal's horns.

It now throws itself backwards and forwards in its attempts to escape, and drags after it for some moments the man who holds the noose. The other man in the meantime endeavours to approach the reindeer, catches the animal by the horns and throws it to the ground, killing it afterwards by a knife-stab behind the shoulder. The reindeer is then handed over to the women, who, by an incision in the side of the belly, take out the entrails. The stomach is emptied of its contents, and is then used to hold the blood. Finally the skin is taken off.

"About 10 o'clock A.M. we commenced our homeward journey. At nightfall we sought to have a roof over our head in a wretched Chukch tent on the shore of Lake Utschunutsch. It was partly sunk in one of the small mounds which are found here along the shore, and which are probably the remains of old Onkilon dwellings. The present inhabitants, two old men and an old woman, had their habitation arranged in the following way:—In the bottom of a cylindrical pit, one metre deep and three and a half to four and a half metres in diameter, a vertical pole was erected, against the upper end of which rested a number of obliquely placed bars, rising from the edge of the pit, which were covered with skins. The enclosure or bed-chamber, peculiar to the Chukch tent, was not wanting here. Otherwise the whole dwelling bore the stamp of poverty and dirt. The food of the inmates appeared to be fish. Of this, besides the fish we obtained here, the nets hanging in front of the tent afforded evidence. Some clothes, an iron pot, two wooden vessels, and a Shaman drum were the only things I could discover in the tent.

"Next morning we continued our journey. On the other side of Lake Utschunutsch we saw two dwellings, which only consisted of boats turned upside down with some hides drawn over them. The rest of the way we came past Najtskaj and through Irgunnuk, where we were received in an exceedingly friendly fashion. By 7 o'clock in the evening of the 11th October we were again on board the *Vega*."

From Lieutenant Hovgaard's report, which principally relates to the topography of the region passed through, we make the following extract relating to the endurance which the Chukches and their dogs showed:—

"During our outward journey, which lasted twenty-one and a half hours, Menka's attendant, the before-mentioned reindeer

owner, whom we at first took to be Menka's slave or servant, ran without interruption before the sledges, and even when we rested he was actively searching for the track, looking after the dogs, &c. When we came to the camp he did not sleep, and, notwithstanding, was as fresh during the following day's journey. During the time he got no spirituous liquor, by express order of Menka, who said that if he did he would not be able to continue to run. Instead he chewed a surprising quantity of tobacco. The dogs, during the whole time, were not an instant unyoked; in the mornings they lay half snowed up, and slept in front of the sledges. We never saw the Chukches give them any food: the only food they got was the frozen excrements of the fox and other animals, which they themselves snapped up in passing. Yet even on the last day no diminution in their power of draught was observable."

Nordquist brought with him, among other things, two reindeer, bought for a rouble and a half each. They were still very serviceable, though badly slaughtered. But the reindeer we purchased farther on in the winter were so poor that no one on board could persuade himself to eat them.

On the 18th October, by which time we believed that Menka would be already at Markova, we were again visited by him and his son-in-law. He said he had no *akmimil* (fire-water) to keep holiday with, and now came to us to exchange three slaughtered reindeer for it. Our miscalculation with respect to the letters, which we hoped were long ago on their way to their destination, and my dislike to the mode of payment in question—I offered him, without success, half-imperials and metal rouble pieces instead of brandy—made his reception on this occasion less hearty, and he therefore left us soon. It was not until the 9th February, 1879, that we again got news from Menka by one of the Chukches, who had attended him the time before. The Chukch said that in ten days he had traversed the way between the *Vega's* winter haven and Markova, which would run to about ninety kilometres a day. According to his statement Menka had travelled with the letters to Yakutsk. The statement

seemed very suspicious, and appeared afterwards to have been partly fabricated, or perhaps to have been misunderstood by us. But after our return to the world of newspapers we found that Menka had actually executed his commission. He, however, did not reach Anadyrsk until the $\frac{\text{7th March}}{\text{23rd February}}$. Thence the packet was sent to Irkutsk, arriving there on the $\frac{\text{10th May}}{\text{28th April}}$. The news reached Sweden by telegraph six days after, on the 16th May, just at a time when concern for the fate of the *Vega* was beginning to be very great, and the question of relief expeditions was seriously entertained.[1]

In order to relieve the apprehensions of our friends at home, it was, however, exceedingly important to give them some accounts of the position of the *Vega* during winter, and I therefore offered all the purchasing power which the treasures of guns, powder, ball, food, fine shirts, and even spirits, collected on board, could exert, in order to induce some natives to convey Lieutenants Nordquist and Bove to Markova or Nischni Kolymsk. The negotiations seemed at first to go on very well, an advance was demanded and given, but when the journey should have commenced the Chukches always refused to start on some pretext or other—now it was too cold, now too dark, now there was no food for the dogs. The negotiations had thus no other result than to make us acquainted with one of the few less agreeable sides of the Chukches' disposition, namely the complete untrustworthiness of these otherwise excellent savages, and their peculiar idea of the binding force of an agreement.

The plans of travel just mentioned, however, led to Lieutenant Nordquist making an excursion with dog-sledges in order to be even with one of the natives, who had received an advance

[1] The King of Sweden has since ordered a gold medal to be given to Wassili Menka in recognition of the fidelity with which he executed the commission of carrying our letters to a Russian post station.

for driving him to Markova, but had not kept his promise. Of this journey Lieutenant Nordquist gives the following account:—

"On the 5th December, at 7.50 A.M., I started with a dog-sledge for the village Pidlin, lying on Kolyutschin Bay. I was driven by the Chukch Auango from Irgunnuk. He had a small, light sledge, provided with runners of whalebone, drawn by six dogs, of which the leader was harnessed before the other five, which were fastened abreast in front of the sledge, each with its draught belt. The dogs were weak and ill managed, and therefore went so slowly that I cannot estimate their speed at more than two or three English miles an hour. As the journey both thither and back lasted eight to nine hours, the distance between Pitlekaj and Pidlin may be about twenty-five English miles.

"Pidlin and Kolyutschin Island are the only inhabited places on Kolyutschin Bay. At the former place there are four tents, pitched on the eastern shore of the bay, the number of the inhabitants being a little over twenty persons. I was received in front of the tents by the population of the village and carried to the tent, which was inhabited by Chepcho, who now promised to go with me in February to Anadyrsk. My host had a wife and three children. At night the children were completely undressed; the adults had short trousers on, the man of tanned skin, the woman of cloth. In the oppressive heat, which was kept up by two train-oil lamps burning the whole night, it was difficult to sleep even in the heavy reindeer-skin dresses. Yet they covered themselves with reindeer skins. Besides the heat there was a fearful stench—the Chukches obeyed the calls of nature within the bedchamber—which I could not stand without going out twice to get fresh air. When we got up next morning our hostess served breakfast in a flat tray, containing first seals' flesh and fat, with a sort of sour-krout of fermented willow-leaves, then seals' liver, and finally seals' blood—all frozen.

"Among objects of ethnographical interest I saw, besides the Shaman drum which was found in every tent, and was not regarded with the superstitious dread which I have often observed elsewhere, a bundle of amulets fastened with a small thong, a wolf's skull, which was also hung up by a thong, the skin together with the whole cartilaginous portion of a wolf's nose and a flat stone. The amulets consisted of wooden forks, four to five centimetres long, of the sort which we often see the

Chukches wear on the breast. My host said that such an amulet worn round the neck was a powerful means of preventing disease. The wolf's skull which I had already got, he took back, because his four- or five-year-old son would need it in making choice of a wife. What part it played in this I did not however ascertain.

"While my driver harnessed the dogs for the journey home, I had an opportunity of seeing some little girls dance, which they did in the same way as that in which I had seen girls dance at Pitlekaj and Yinretlen. Two girls then place themselves either right opposite to or alongside of each other. In the former case they often lay their hands on each other's shoulders, bend by turns to either side, sometimes leap with the feet held together and wheel round, while they sing or rather grunt the measure.

"The journey home was commenced at eight o'clock in the morning. In the course of it my driver sang Chukch songs. These are often only imitations of the cries of animals or improvisations without any distinct metre or rhythm, and very little variation in the notes; only twice I thought I could distinguish a distinct melody. In the afternoon my driver told me the Chukch names of several stars. At five o'clock in the afternoon I reached the *Vega*."

On the 10th October, the new ice at many places in the neighbourhood of the vessel was still so weak that it was impossible to walk upon it, and blue water-skies at the horizon indicated, that there were still considerable stretches of open water in the neighbourhood. But the drift-ice round about us lay so rock-fast, that I could already take solar altitudes from the deck of the vessel with a mercurial horizon. In order to ascertain the actual state of the case with reference to the open water, excursions were undertaken on the 13th October, in different directions. Dr. Kjellman could then, from the rocky promontory at Yinretlen, forty-two metres high, see large open spaces in the sea to the northward. Dr. Almquist went right out over the ice, following the track of Chukches, who had gone to catch seals. He travelled about twenty kilometres over closely packed drift-ice fields, without reaching open water, and found the newly frozen

ice, with which the pieces of drift-ice were bound together, still everywhere unbroken. The Chukches, who visited the vessel in dog-sledges on the 28th October, informed us, however, that the sea a little to the east of us was still completely open.

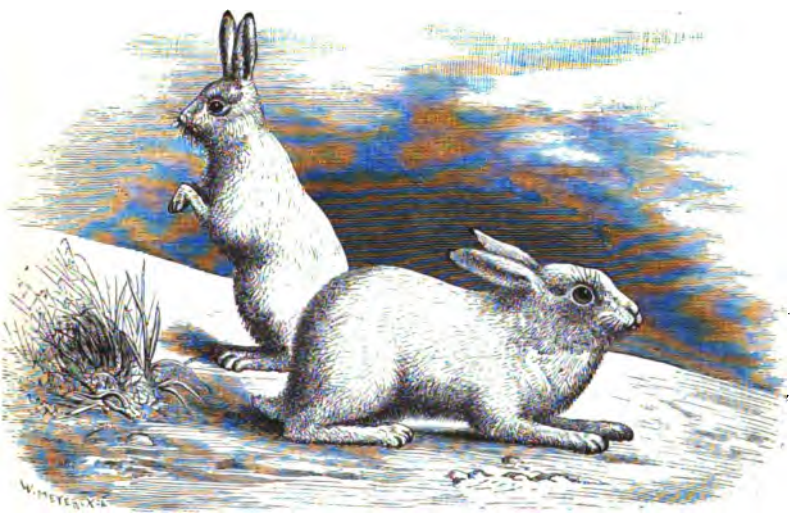
On the 15th October the hunter Johnsen returned from a hunting expedition quite terrified. He informed us that during his wanderings on the *tundra*, he had found a murdered man and brought with him, with the idea that, away here in the land of the Chukches, similar steps ought to be taken as in those lands which are blessed by a well-ordered judiciary, as *species facti*, some implements lying beside the dead man, among which was a very beautiful lance, on whose blade traces of having been inlaid in gold could still be discovered. Fortunately he had come with these things through the Chukch camp unobserved. From the description which was given me, however, I was able immediately to come to the conclusion that the question here was not of any murder, but of a dead man laid out on the *tundra*. I requested Dr. Almquist to visit the place, in order that he might make a more detailed examination. He confirmed my conjecture. As wolves, foxes, and ravens had already torn the corpse to pieces, the doctor considered that he, too, might take his share, and therefore brought home with him from his excursion, an object carefully wrapped up and concealed among the hunting equipment, namely, the Chukch's head. It was immediately sunk to the sea-bottom, where it remained for a couple of weeks to be skeletonised by the crustacea swarming there, and it now has its number in the collections brought home by the *Vega*. This sacrilege was never detected by the Chukches, and probably the wolves got the blame of it, as nearly every spring it was seen that the corpse, which had been laid out during autumn, lost its head during winter. It was, perhaps, more difficult to explain the disappearance of the lance, but of this, too, the maws of the wolves might well bear the blame.

Our hunters now made hunting excursions in different directions, but the supply of game was scanty. The openings in the ice probably swarmed with seals, but they were too distant, and without a boat it was impossible to carry on any hunting there. Not a single Polar bear now appeared to be visible in the neighbourhood, although bears' skulls are found at

CHUKCH BONE-CARVINGS.
(The two largest figures represent bears.)

several places on the beach, and this animal appears to play a great part in the imagination of the natives, to judge of the many figures of bears among the bone carvings I purchased from the Chukches. The natives often have a small strip of bear's skin on the seat of their sledges, but I have not seen any whole bear's skin here; perhaps the animal is being exter-

minated on the north coast of Siberia. Our wintering, therefore, will not enrich Arctic literature with any new bear stories—a very sensible difficulty for the writer himself. Wolves, on the other hand, occur on the *tundra* in sufficient abundance, even if one or other of the wolves found in mist and drifting snow, and saluted with shot, turned out, on a critical determination of species, to be our own dogs. At least, this was the case with the "wolf," that inveigled one of the crew into shooting a ball one dark night right through the thermometer case, fortunately



HARES FROM CHUKCH LAND.

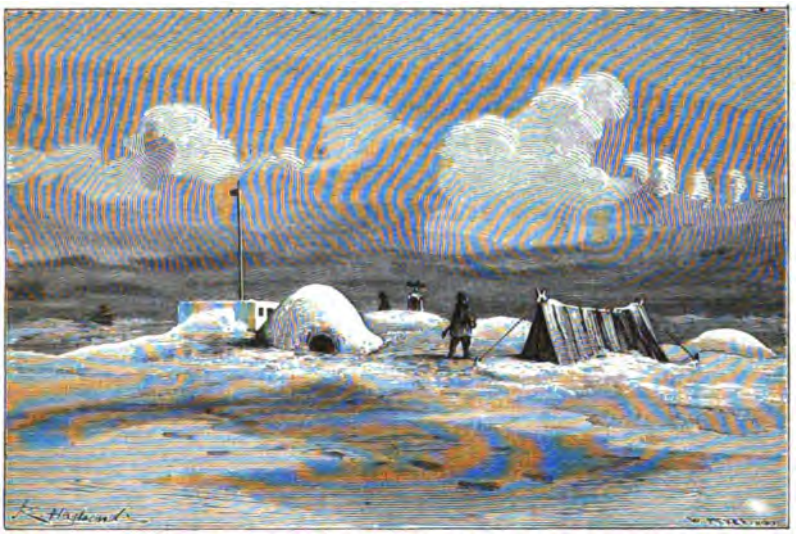
without injuring the instruments, and with no other result than that he had afterwards to bear an endless number of jokes from his comrades on account of his wolf-hunt. Foxes, white, red and black, also occurred here in great numbers, but they were at that season difficult to get at, and besides they had perhaps withdrawn from the coast. Hares, on the other hand, maintained themselves during the whole winter at Yinretlen, by day partly out on the ice partly on the cape, by night in the neighbourhood

house had a sail drawn over it. As supports of the three variation instruments large blocks of wood were used, whose lower ends were sunk in pits, which, with great trouble, were excavated in the frozen ground, and then, when the block supports were placed, were filled with sand mixed with water.

The ice-house was a spacious observatory, well-fitted for its purpose in every respect. It had but one defect, the temperature was always at an uncomfortably low point. As no iron could be used in the building, and we had no copper-stove with us, we could not have any fireplace there. We endeavoured, indeed, to use a copper fireplace, that had been intended for sledge journeys, for heating, but only with the result that the observatory was like to have gone to pieces. We succeeded little better when we discovered farther on in the winter, while trimming the hold, a forgotten cask of bear's oil. We considered this *find* a clear indication that instead of a stove fired with wood we should, according to the custom of the Polar races, use oil-lamps to mitigate the severe cold which deprived our stay in Tintinyaranga of part of its pleasure. But this mode of firing proved altogether impracticable. The fumes of the oil smelled worse than those of the charcoal, and the result of this experiment was none other than that the splendid crystals of ice, with which the roof and walls of the ice-house were gradually clothed, were covered with black soot. Firing with oil was abandoned, and the oil presented to our friends at Yinretlen, who just then were complaining loudly that they had no other fuel than wood.

Besides the nine scientific men and officers of the *Vega*, the engineer Nordström and the seaman Lundgren took part in the magnetical and meteorological observations. Every one had his watch of six hours, five of which were commonly passed in the ice-house. To walk from the vessel to the observatory, distant a kilometre and a half, with the temperature under the freezing point of mercury, or, what was much worse, during storm, with

the temperature at −36°, remain in the observatory for five hours in a temperature of −17°, and then return to the vessel, commonly against the wind—for it came nearly always from the north or north-west—was dismal enough. None of us, however, suffered any harm from it. On the contrary, it struck me as if this compulsory interruption to our monotonous life on board



THE OBSERVATORY AT PITLEKAJ.
(After a drawing by O. Nordquist.)

and the long-continued stay in the open air had a refreshing influence both on body and soul.

In the neighbourhood of the ice-house the thermometer case was erected, and farther on in the winter there were built in the surrounding snowdrifts, two other observatories, not however of ice, but of snow, in the Greenland snow-building style. Our depôt of provisions was also placed in the neighbourhood, and at a sufficient distance from the magnetical observatory there

was a large wooden chest, in which the Remington guns, which were carried for safety in excursions from the vessel, and other iron articles which the observer had with him, were placed before he entered the observatory.

The building of Tintinyaranga was followed by the Chukches with great interest. When they saw that we did not intend to live there, but that rare, glancing metal instruments were set up in it, and that a wonderfully abundant flood of light in comparison with their tent illumination was constantly maintained inside with a kind of light quite unknown to them (stearine candles and photogen lamps) a curious uneasiness began to prevail among them, which we could not quiet with the language of signs mixed with a Chukch word or two, to which our communications with the natives were at that time confined. Even farther on in the year, when an efficient though word-poor international language had gradually been formed between us, they made inquiries on this point, yet with considerable indifference. All sensible people among them had evidently already come to the conclusion that it was profitless trouble to seek a reasonable explanation of all the follies which the strange foreigners, richly provided with many earthly gifts but by no means with practical sense, perpetrated. In any case it was with a certain amazement and awe that they, when they exceptionally obtained permission, entered one by one through the doors in order to see the lamps burn and to peep into the tubes. Many times even a dog-team that had come a long way stopped for a few moments at the ice-house to satisfy the owner's curiosity, and on two occasions in very bad drifting weather we were compelled to give shelter to a wanderer who had gone astray.

When this ice-house was ready and hourly observations began in it, life on board took the stamp which it afterwards retained in the course of the winter. In order to give the reader an idea of our every-day life, I shall reproduce here the spirited sketch

of a day on the *Vega*, which Dr. Kjellman gave in one of his home letters:—

"It is about half-past eight in the morning. He whose watch has expired has returned after five hours' stay in the ice-house, where the temperature during the night has been about −16°. His account of the weather is good enough. There are only thirty-two degrees of cold, it is half-clear, and, to be out of the ordinary, there is no wind. Breakfast is over. Cigars, cigarettes, and pipes are lighted, and the gunroom *personnel* go up on deck for a little exercise and fresh air, for below it is confined and close. The eye rests on the desolate, still faintly-lighted landscape, which is exactly the same as it was yesterday; a white plain in all directions, across which a low, likewise white, chain of hillocks or *torosses* here and there raises itself, and over which some ravens, with feeble wing-strokes, fly forward, searching for something to support life with. 'Metschinko Orpist,' 'metschinko Okerpist,' 'metschinko Kellman,' &c., now sounds everywhere on the vessel and from the ice in its neighbourhood. 'Orpist' represents Nordquist, 'Okerpist' again Stuxberg. It is the Chukches' morning salutation to us. To-day the comparatively fine weather has drawn out a larger crowd than usual, thirty to forty human beings, from tender sucking babes to grey old folks, men as well as women; the latter in the word of salutation replacing the *tsch*-sound with an exceedingly soft caressing *ts*-sound. That most of them have come driving is shown by the equipages standing in the neighbourhood of the vessel. They consist of small, low, narrow, light sledges, drawn by four to ten or twelve dogs. The sledges are made of small pieces of wood and bits of reindeer-horn, held together by sealskin straps. As runner-shoes thin plates of the ribs of the whale are used. The dogs, sharp-nosed, long-backed, and excessively dirty, have laid themselves to rest, curled together in the snow.

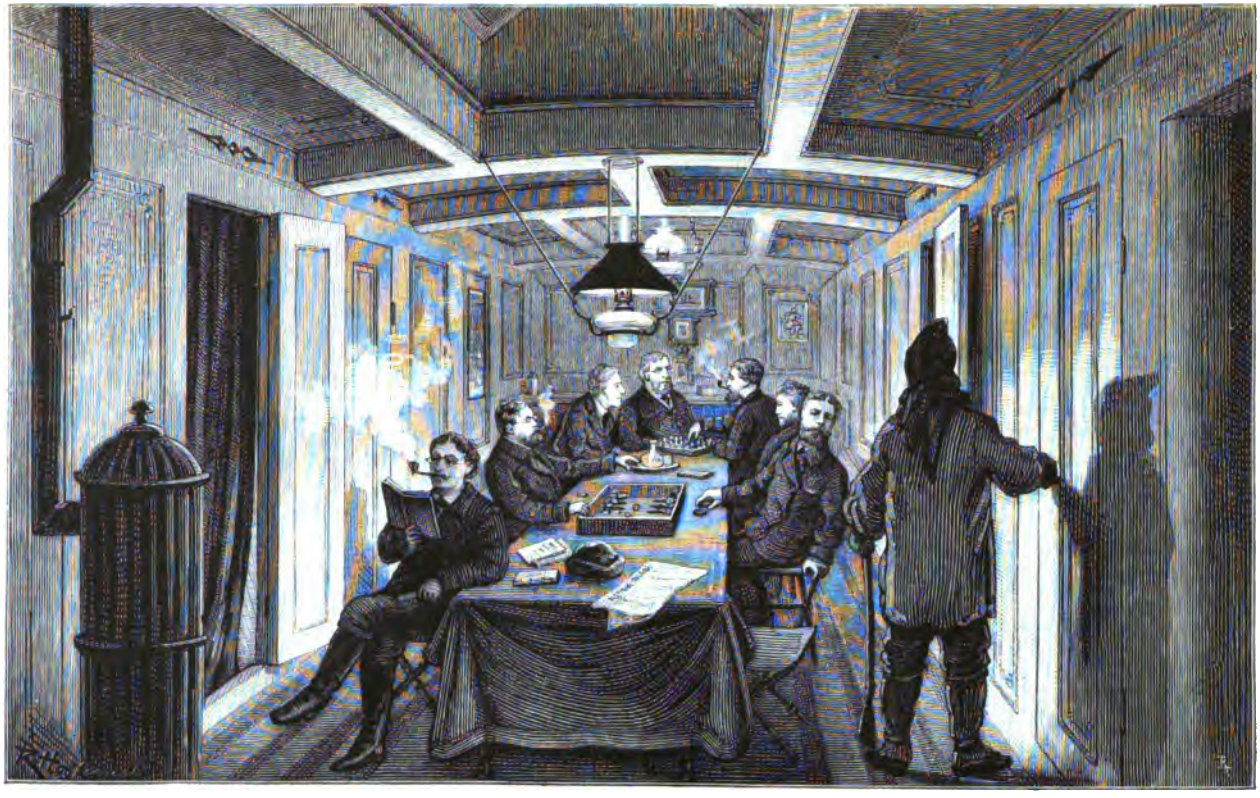
"The salutation is followed almost immediately to-day as on preceding days by some other words: 'Ouinga mouri kauka,' which may be translated thus: 'I am so hungry; I have no food; give me a little bread!' They suffer hunger now, the poor beings. Seal flesh, their main food, they cannot with the best will procure for the time. The only food they can get consists of fish (two kinds of cod), but this is quite too poor diet for them, they have fallen off since we first met with them.

"Soon we are all surrounded by our Chukch acquaintances.

The daily market begins. They have various things to offer, which they know to be of value to us, as weapons, furs, ornaments, playthings, fish, bones of the whale, algæ, vegetables, &c. For all this only 'kauka' is now asked. To-day the supply of whales' bones is large, in consequence of our desire, expressed on previous days, to obtain them. One has come with two vertebræ, one with a rib or some fragments of it, one with a shoulder-blade. They are not shy in laying heavy loads on their dogs.

"After the close of the promenade and the traffic with the natives, the gunroom *personnel* have begun their labours. Some keep in their cabins, others in the gunroom itself. The magnetical and meteorological observations made the day before are transcribed and subjected to a preliminary working-out, the natural history collections are examined and looked over, studies and authorship are prosecuted. The work is now and then interrupted by conversation partly serious, partly jocular. From the engine-room in the neighbourhood we hear the blows of hammers and the rasping of files. In the 'tweendecks, pretty well heated, but not very well lighted, some of the crew are employed at ordinary ship's work; and in the region of the kitchen the cook is just in the midst of his preparations for dinner. He is in good humour as usual, but perhaps grumbles a little at the 'mosucks' (a common name on board for the Chukches), who will not give him any peace by their continual cries for 'mimil' (water.)

"The forenoon passes in all quietness and stillness. Immediately after noon nearly all the gunroom people are again on deck, promenading backwards and forwards. It is now very lively. It is the crew's meal-time. The whole crowd of Chukches are collected at the descent to their apartment, the lower deck. One soup basin after the other comes up; they are immediately emptied of their contents by those who in the crowd and confusion are fortunate enough to get at them. Bread and pieces of meat and bits of sugar are distributed assiduously, and disappear with equal speed. Finally, the cook himself appears with a large kettle, containing a very large quantity of meat soup, which the Chukches like starving animals throw themselves upon, baling into them with spoons, empty preserve tins, and above all with the hands. Notwithstanding the exceedingly severe cold a woman here and there has uncovered one arm and half her breast in order not to be embarrassed by the wide reindeer-skin sleeve in her attempts to get at the contents of the kettle. The spectacle is by no means a pleasant one.



AN EVENING IN THE GUNROOM OF THE "VEGA" DURING THE WINTERING.

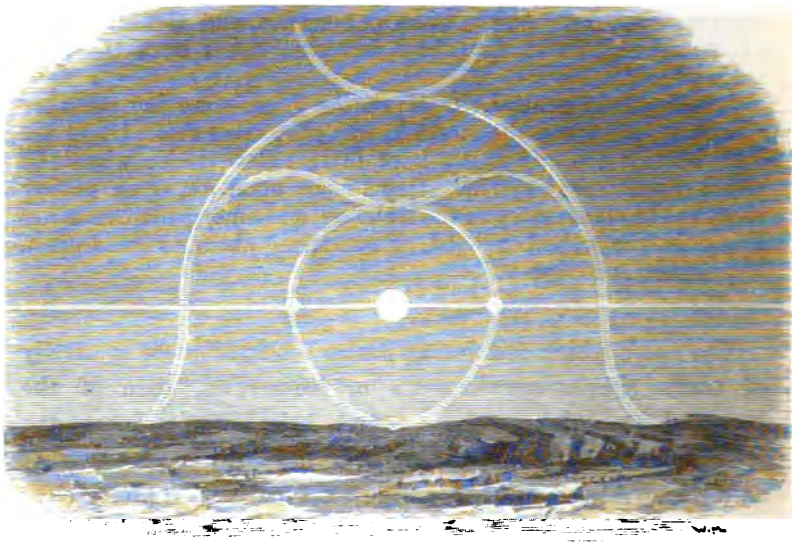
"By three o'clock it begins to grow dark, and one after the other of our guests depart, to return, the most of them, in the morning. Now it is quiet and still. About six the crew have finished their labours and dispose of the rest of the day as they please. Most of them are occupied with reading during the evening hours. When supper has been served at half-past seven in the gunroom, he who has the watch in the ice-house from nine to two next morning prepares for the performance of his disagreeable duty; the rest of the gunroom *personnel* are assembled there, and pass the evening in conversation, play, light reading, &c. At ten every one retires, and the lamps are extinguished. In many cabins, however, lights burn till after midnight.

"Such was in general our life on the *Vega*. One day was very like another. When the storm howled, the snow drifted, and the cold became too severe, we kept more below deck; when the weather was finer we lived more in the open air, often paying visits to the observatory in the icehouse, and among the Chukches living in the neighbourhood, or wandering about to come upon, if possible, some game."

The snow which fell during winter consisted more generally of small simple snow-crystals or ice-needles, than of the beautiful snow-flakes whose grand kaleidoscopic forms the inhabitants of the north so often have an opportunity of admiring. Already with a gentle wind and with a pretty clear atmosphere the lower strata of the atmosphere were full of these regular ice-needles, which refracted the rays of the sun, so as to produce parhelia and halos. Unfortunately however these were never so completely developed as the halos which I saw in 1873 during the sledge-journey round North-east Land on Spitzbergen; but I believed that even now I could confirm the correctness of the observation I then made, that the representation which is generally given of this beautiful phenomenon, in which the halo is delineated as a collection of regular circles, is not correct, but that it forms a very involved system of lines, extended over the whole vault of heaven, for the most part coloured on the sun-side and uncoloured on the opposite side, of the sort

shown in the accompanying drawings taken from the account of the Spitzbergen Expedition of 1872-73.

Another very beautiful phenomenon, produced by the refraction of the solar rays by the ice-needles, which during winter were constantly mixed with the atmospheric strata lying nearest the surface of the earth, was that the mountain heights to the south of the *Vega* in a certain light appeared



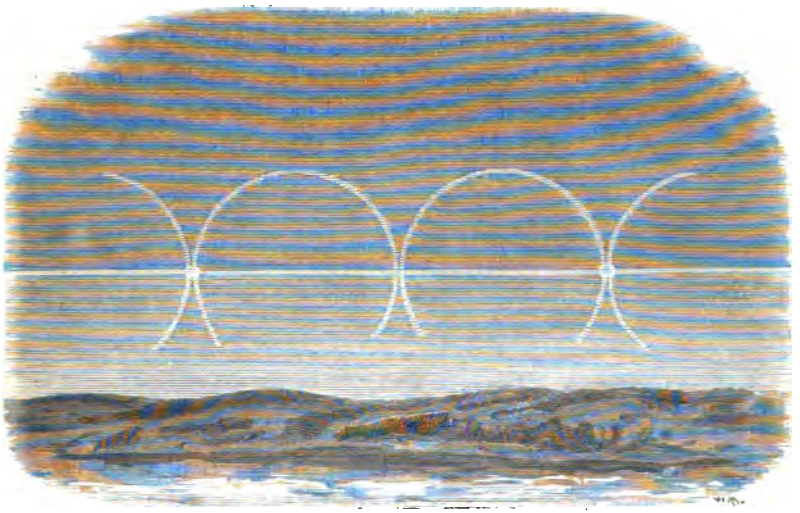
REFRACTION-HALO.

Seen on Spitzbergen in May 1873, simultaneously with the Reflection-halo delineated on the following page.

as if feathered with fire-clouds. In clear sunshine and a high wind we frequently saw, as it were, a glowing pillar of vapour arise obliquely from the summits of the mountains, giving them the appearance of volcanos, which throw out enormous columns of smoke, flame-coloured by the reflection from the glowing lava streams in the depths of the crater.

A blue water-sky was still visible out to sea, indicating that open water was to be found there. I therefore sent Johnsen the

hunter over the ice on the 18th December to see how it was. In three-quarters of an hour's walking from the vessel he found an extensive opening, recently covered with thin, blue, newly frozen ice. A fresh northerly breeze blew at the time, and by it the drift-ice fields were forced together with such speed, that Johnsen supposed that in a couple of hours the whole lead would be completely closed



REFLECTION-HALO.

Seen simultaneously with the Refraction-halo delineated on the preceding page, in the part of the sky opposite the sun.

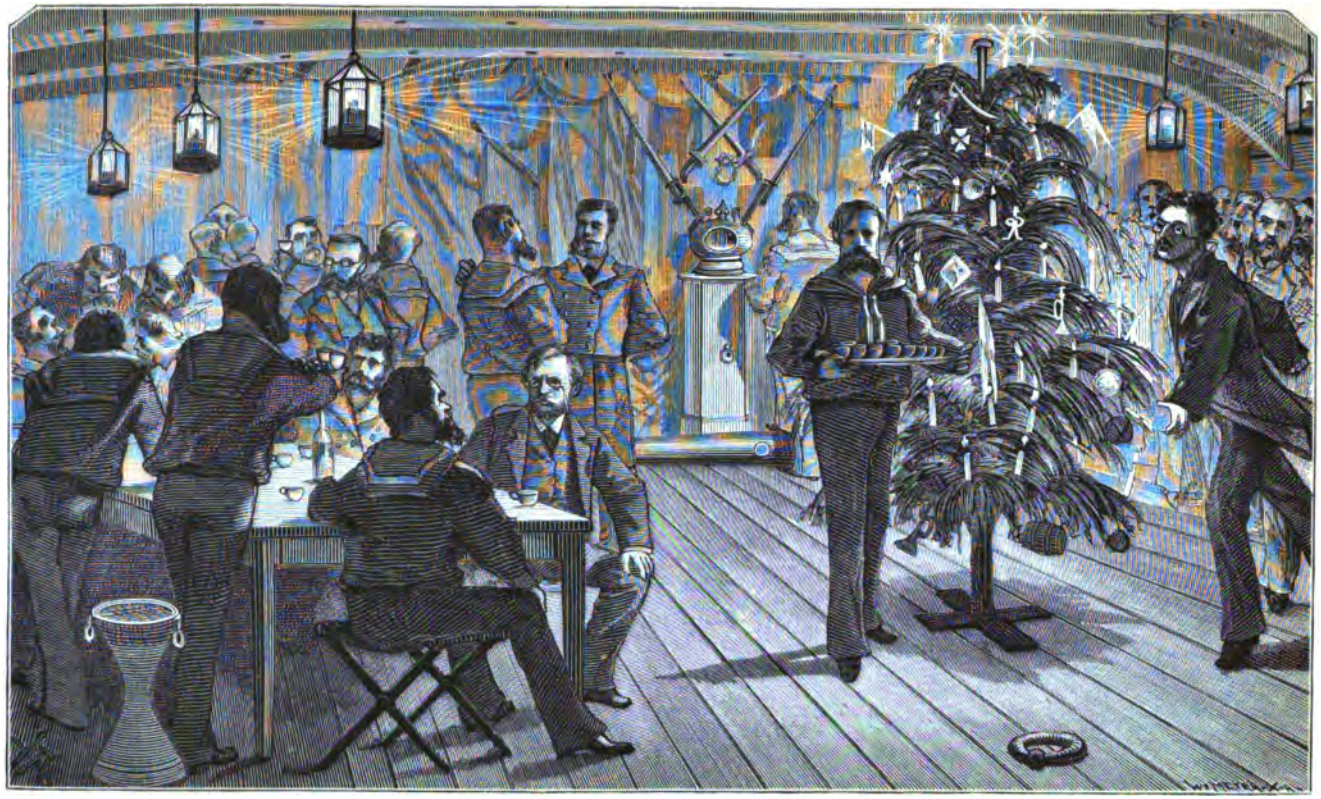
In such openings in Greenland white whales and other small whales are often enclosed by hundreds, the natives thus having an opportunity of making in a few hours a catch which would be sufficient for their support during the whole winter, indeed for years, if the idea of *saving* ever entered into the imagination of the savage. But here in a region where the pursuit of the whale is more productive than in any other sea, no such occurrence has happened. During the whole of our stay on the coast

of the Chukch country we did not see a single whale. On the other hand, masses of whales' bones were found thrown up on the beach. At first I did not bestow much attention upon them, thinking they were the bones of whales that had been killed during the recent whale-fishing period. I soon found however that this could not have been the case. For the bones had evidently been washed out of the sandy dune running along the beach, which had been deposited at a time when the present coast lay ten to twenty metres below the surface of the sea, thus hundreds or thousands of years ago, undoubtedly before the time when the north coast of Asia was first inhabited by man. The dune sand is, as recently exposed profiles show, quite free from other kitchen-midden remains than those which occur

SECTION OF THE BEACH STRATA AT PITLEKAJ.

1. Hard frozen coarse sand. 2. The sea. 3. Beach of fine dry sand with masses of bones of the whale. 4. Coast-lagoon.

upon its surface. The whales' bones in question were thus *subfossil*. Their number was so great, that in the systematic examination of the beach in the immediate neighbourhood of the vessel, which I undertook during spring with the assistance of Dr. Kjellman and half a dozen of the sailors, thirty neck-bones and innumerable other bones of the whale were found in a stretch of from four to five kilometres. Of course masses of bones are still concealed in the sand; and a large number of lower jaw-bones, ribs, shoulder-blades, and vertebræ had been used for runner-shoes, tent-frames, spades, picks and other implements. A portion, after being exposed for several years to the action of the air, had undergone decay. The bones are therefore found in greatest number at those places where the sand of



CHRISTMAS EVE ON THE "VEGA."

the dune has been recently carried away by the spring floods or by the furious winds which prevail here, and which easily gain the ascendency over the dry sand, bound together only by widely scattered Elymus-stalks. The largest crania belonged to a species nearly allied to the *Balæna mysticetus*. Crania of a species of Rachianectes are also found along with some bones of smaller varieties of the whale. No complete skeleton however has been found, but we brought home with us so large a quantity of the loose bones that the collection of whales' bones alone would have formed a full cargo for a small vessel. These bones will be delineated and described by Professor. A. W. MALM in *The Scientific Work of the Vega Expedition*. Special attention was drawn to a skeleton, belonging to the *Balæna mysticetus*, by its being still partially covered with skin, and by deep red, almost fresh, flesh adhering to those parts of it which were frozen fast in the ground. This skeleton lay at a place where the dune sand had recently been washed away and the coarse underlying sand uncovered, the whale-*mummy* also I suppose coming to light at the same time. That the whale in question had not stranded in the memory of man the Chukches assured me unanimously. In such a case we have here a proof that even portions of the flesh of gigantic sea-animals have been protected against putrefaction in the frozen soil of Siberia—a parallel to the mammoth-*mummies*, though from a considerably more recent period.

Christmas Eve was celebrated in the usual northern fashion. We had indeed neglected, as in the Expedition of 1872-73, to take with us any Christmas tree. But instead of it Dr. Kjellman prevailed on our Chukch friends to bring with dog-sledges willow-bushes from the valleys lying beyond the mountains to the south. By means of these a bare driftwood stem was converted into a luxuriant, branchy tree which, to replace the verdure, was clothed with variegated strips of paper, and planted in the 'tweendecks, which after our enclosure in the ice had

been arranged as a working room, and was now set in order for the Christmas festivities, and richly and tastefully ornamented with flags. A large number of small wax-lights, which we had brought with us for the special purpose, were fixed in the Christmas tree, together with about two hundred Christmas boxes purchased or presented to us before our departure. At six o'clock in the afternoon all the officers and crew assembled in the 'tweendecks, and the drawing of lots began, now and then interrupted by a thundering polka round the peculiar Christmas tree. At supper neither Christmas ale nor ham was wanting. And later in the evening there made their appearance in the 'tweendecks five punchbowls, which were emptied with songs and toasts for King and Fatherland, for the objects of the Expedition, for its officers and men, for the families at home, for relatives and friends, and finally for those who decked and arranged the Christmas tree, who were the sailors C. Lundgren and O. Hansson, and the firemen O. Ingelsson and C. Carlström.

The other festivals were also celebrated in the best way, and at midnight before New Year's Day the new year was shot in with sharp explosive-shell firing from the rifled cannon of the *Vega*, and a number of rockets thrown up from the deck.

END OF VOL. I.

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